2011 Data Summary Report

July 2012

Grasse River Study Area
Massena, New York

ALCOA

Alcoa Inc.
Massena, New York

145540

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EXECUTIVE SUMMARY

The Supplemental Remedial Studies (SRS) program was initiated in 1995 to provide information to support the identification and evaluation of potential remedial alternatives for the lower Grasse River. Initially, the program was designed to obtain information pertinent to polychlorinated biphenyl (PCB) sources and fate and transport mechanisms and document spatial and seasonal variations in PCB levels in the water column and fish. Over the past several years the program has focused on the continued monitoring of long-term trends in water column and fish tissue PCB levels, as well as the annual documentation of ice formation and breakup on the river. This report details the field sampling activities and data collected from the Grasse River Study Area during the 2011 field sampling season and 2011/2012 ice monitoring. The major conclusions are summarized below.

Water column monitoring in 2011 consisted of the collection of water samples from four locations throughout the river every three weeks between May and October. Total suspended solids (TSS) and PCB data collected in 2011 are consistent with data collected over the past several years. During periods when the river is not stratified, total PCB levels generally increase with distance downstream. During periods when the river is stratified, this pattern is interrupted by a downward trend in PCB concentration that is the result of dilution of the Grasse River water with water from the St. Lawrence River. Overall, average PCB concentrations and fluxes in 2011 are similar to or lower than levels measured over the past few years (i.e., since the 2005 Remedial Options Pilot Study [ROPS]). TSS levels measured throughout the lower river were low with a maximum of 7.5 milligrams per liter (mg/L).

Resident fish monitoring was conducted in fall 2011 and consisted of the collection of adult smallmouth bass, adult brown bullhead, and young-of-year (YOY) spottail shiner from the Study Area. Average lipid-based PCB concentrations measured in 2011 exhibit a continued long-term decline in PCB levels since the early to mid-1990s. Since the early to mid-1990s, stretch-specific average lipid-based PCBs measured in smallmouth bass and brown bullhead have declined by 93% to 97% and 92% to 94%, respectively. For YOY spottail shiner, average lipid-based PCBs have declined by 49% to 82% in the lower river and about 50% at the river mouth since 1999. For smallmouth bass and brown bullhead, average lipid based PCB concentrations in 2011 (all river locations) are the lowest on record.

Field reconnaissance of fish advisory signs was also conducted as part of the 2011 SRS program. On June 22, 2011, field crews reported that all of the fishing advisory signs were visible from shore and were in good condition.

Monitoring of river ice formation and breakup during the 2011 to 2012 winter included the review of climatological conditions, river stage and flow monitoring, ice thickness measurements and numerical simulations, and a summary of field observations and photo documentation. Ice cover on the lower Grasse River was first observed on December 27, 2011, and consistent ice cover remained through early March 2012, at which time the river experienced a gradual melt-out. The official ice out date was determined to be March 15, 2012. Field crews did not observe movement of ice floes from the upper river into the lower river during the thermal melt-out period. Based on the visual observations and supporting data on stage height, river flow, air temperature, precipitation and ice thickness measurements, the March 2012 breakup was characterized as a thermal melt-out that did not create ice jam conditions in the lower Grasse River.

SECTION 1
INTRODUCTION

The Study Area is located along the northern boundary of New York (NY) State in the town and village of Massena, and encompasses approximately 8.5 miles of the Grasse River from Massena (just downstream of the Route 37 Bridge) to the confluence of the St. Lawrence River (**Figure 1-1**). The Study Area also includes Robinson Creek (which discharges to the St. Lawrence River) and the Massena Power Canal (which extends from the Massena Intake Dam located on the St. Lawrence River to the former Massena Power Dam). Monitoring and sampling activities were performed throughout the Study Area (except Robinson Creek).

The 2011 sampling program included the following activities:

2011 Supplemental Remedial Studies (SRS) Program

- routine water column monitoring;
- resident fish trend monitoring; and
- field reconnaissance of fish advisory signs.

2011/2012 River Ice Monitoring

- climatological monitoring;
- river stage monitoring;
- ice thickness monitoring and predictive modeling; and
- monitoring of river ice breakup.

The field sampling activities included as part of the 2011 SRS program were conducted consistent with those performed in 2008 through 2010 in accordance with the *2008 Routine Monitoring Activities Correspondence* (as defined in the *2008 Data Summary Report;* Alcoa, June 2009) and the procedures identified in the *2005 Monitoring Work Plan* (Alcoa, March 2005). Field activities related to river ice monitoring were conducted in accordance with the modified monitoring program presented and discussed at the United States Environmental Protection Agency (USEPA) Technical Team meeting on December 18, 2008, and approved by

USEPA in an email dated January 19, 2009. **Table 1-1** provides a summary of each sampling event conducted and the total number of samples collected as a result of each activity.

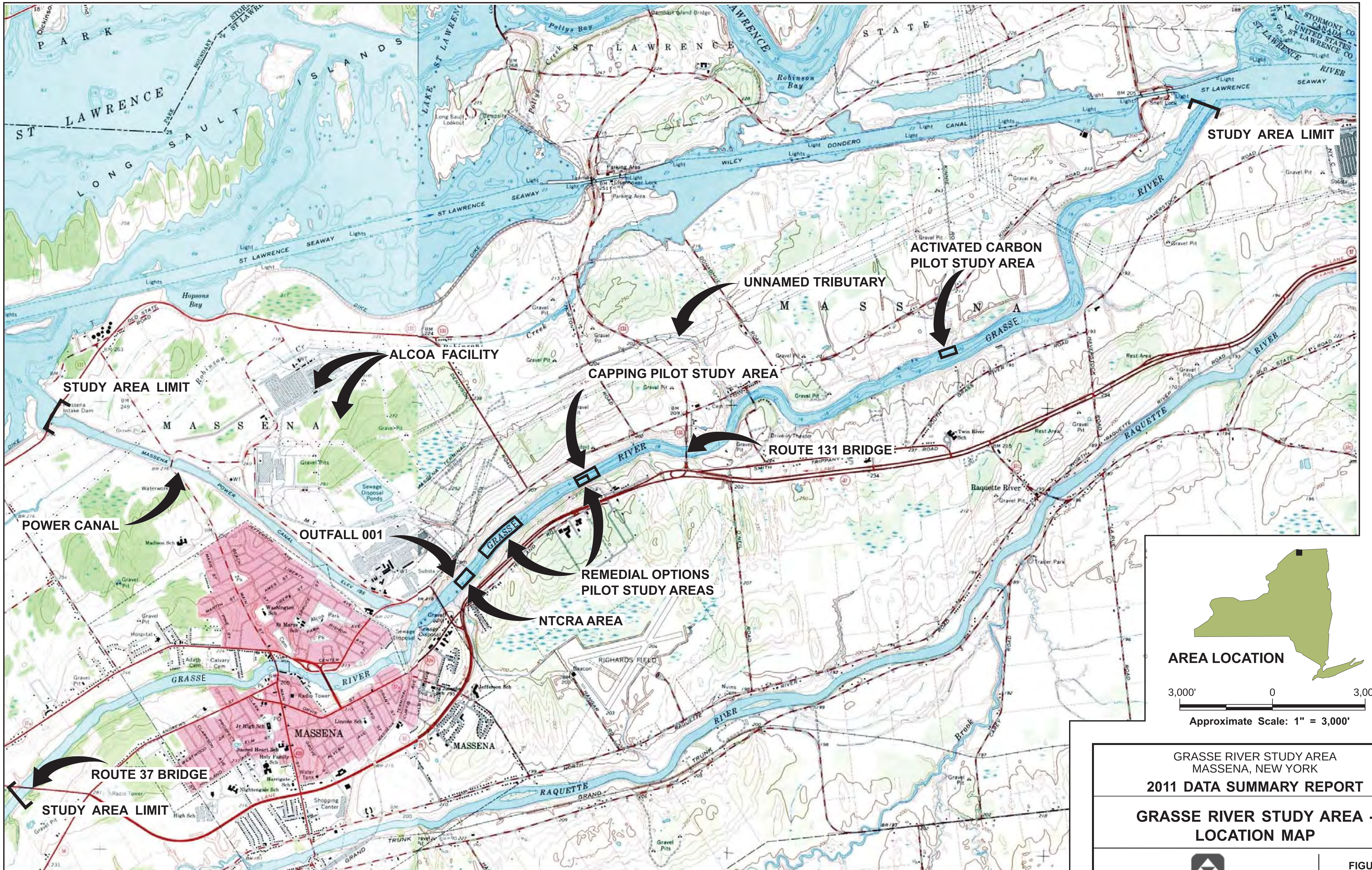
Sample collection summaries and results for the SRS Program and river ice monitoring are provided in Sections 2 and 3, respectively. Section 4 presents a review of the quality assurance/quality control (QA/QC) samples collected and analyzed as part of the above studies. In addition to the main body of this report, two appendices are included. The electronic project database containing field-derived data from the 2011 sampling programs discussed in this report, as well as data collected historically from the river, is included in both Microsoft Access and USEPA Region 2 Electronic Data Deliverable (EDD) formats in **Appendix A**. **Appendix B** contains the spring 2012 ice monitoring photos.

Table 1-1.
2011 Data Collection Summary

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Program	Activity	Number of Sampling Events	Number of Field Samples[1]	Laboratory Analyses
2011 SRS	Routine Water Column	9	63	PCB, TSS
	Resident Fish	1	144	PCB, Percent Lipid
	Fish Advisory Signs	1	N/A	Visual Observation Only
2011/2012 Ice Monitoring	Ice	1	N/A	Visual Observation Only

Notes:
1. Counts do not include QA/QC samples. Counts do not include multiple samples to be analyzed for various parameters from the same location/sample submitted to the same laboratory.
2. N/A - Not Applicable; PCB - polychlorinated biphenyls; TSS - total suspended solids; SRS - Supplemental Remedial Studies; QA/QC - Quality Assurance/Quality Control
3. One additional sampling program was conducted in 2011 and is summarized elsewhere:
   - river ice monitoring over winter 2010/2011 (Alcoa, July 2011).



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

2011 DATA SUMMARY REPORT

GRASSE RIVER STUDY AREA - LOCATION MAP

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FIGURE
1-1

06/07/2012 SYRACUSE, NY-ENV/CAD-DJHOWES
B0010862/2011/00003/CDR/10862N01.CDR

REFERENCE: MASSENA, NEW YORK-ONTARIO USGS QUAD. 1964 RAQUETTE RIVER, NEW YORK-ONTARIO USGS QUAD. 1964

SECTION 2
2011 SRS PROGRAM

2.1 ROUTINE WATER COLUMN MONITORING

2.1.1 Monitoring Activities

Routine water column monitoring was performed every 3 weeks between May and October 2011 (for a total of nine sampling rounds) to continue the ongoing monitoring of polychlorinated biphenyl (PCB) concentrations in the water column and document variations associated with location, season, flow, temperature, and other variables. Water column samples were routinely collected from four locations (**Figure 2-1**) – Main Street Bridge in Massena (WCMSB); Route 131 Bridge (water column transect (WC) 131); WC011; and WC013. Samples were collected from these four locations on the dates provided below:

- Round 1: May 10, 2011
- Round 2: June 2, 2011
- Round 3: June 22, 2011
- Round 4: July 14, 2011
- Round 5: August 2, 2011
- Round 6: August 25, 2011
- Round 7: September 14, 2011
- Round 8: October 3, 2011
- Round 9: October 25, 2011

During each event, samples were collected at each location using a stainless steel Kemmerer water sampler. At WC131, WC011, and WC013 one sample was collected mid-channel from each location at 0.2 and 0.8 times the total water column depth (i.e., total of two samples per location). Due to shallow water depths at WCMSB, one sample was collected at 0.5 times the total water column depth. Sampling was performed via boat at all locations except WCMSB, where samples were collected just downstream of the Main Street Bridge from the north shore as water depths and access limitations precluded collection with a boat.

Prior to the collection of samples at WC131, WC011, and WC013, the total water column depth was recorded and specific conductivity and water temperature measurements were obtained every 2 feet (ft.) in the water column (at mid-channel) to check for the presence of stratification. Field water quality measurements of specific conductivity, water temperature, pH, turbidity, and dissolved oxygen (DO) were also collected at 0.2 and 0.8 times the total water column depth (at mid-channel). Similarly, these field parameters were collected at WCMSB from the north shore just downstream of the bridge at 0.5 times the total water column depth.

All monitoring activities were conducted consistent with those performed in 2008 through 2010 in accordance with the *2008 Routine Monitoring Activities Correspondence* and the procedures identified in the *2005 Monitoring Work Plan* (Alcoa, March 2005). Additional pertinent information relative to field activities for each sampling round and any necessary variations to the protocol described in the *2005 Monitoring Work Plan* (Alcoa, March 2005) are provided in **Table 2-1**.

A total of 63 water samples (not including QA/QC samples) were packaged and submitted to Northeast Analytical, Inc., a division of Pace Analytical Services (hereinafter referred to as Pace) in Schenectady, NY, consistent with the methodologies outlined in the *2005 Monitoring Work Plan* (Alcoa, March 2005). Water column samples were analyzed for PCB congeners and total suspended solids (TSS). QA/QC sampling included the collection of an equipment rinse blank before and after each sampling round, and one duplicate and one matrix spike/matrix spike duplicate (MS/MSD) each round. The equipment rinse blank and MS/MSD samples were analyzed for PCB congeners, and the duplicate samples were analyzed for PCB congeners and TSS. Details on the results of the QA/QC sampling are presented in Section 5.

2.1.2 Summary of Results

Routine water column monitoring data from 2011 can be found on the attached CD-ROM (**Appendix A**) in the Access and EQuIS data tables entitled climate, riverflow_ChaseMills, riverflow_hist, riverflow_tapedown, water_field, and water_iupac. PCB and TSS results for 2011 are also summarized in **Tables 2-2** and **2-3**.

2.1.2.1 River Flow and Precipitation

Daily flow and precipitation data measured in 2011 are shown in **Figure 2-2**. The 2011 annual average flow estimated from 15-minute provisional flow records from the United States Geological Survey (USGS) gage on the Grasse River at Chase Mills was approximately 1,612 cubic feet per second (cfs), which is higher than the historic long-term average Grasse River flow of 1,100 cfs (Alcoa, April 2001). At the Chase Mills gage, the spring-time peak daily average flow of 8,356 cfs was observed on May 17. Flows decreased during the summer months (i.e., June through September), with an average flow of 713 cfs. Flows increased in mid-to-late October to a maximum daily average of 3,378 on October 17 due to significant precipitation events.

Total precipitation measured near Outfall 007 during 2011 was approximately 35 inches (in.), which is similar to the total precipitation in 2010 (37 in.) and higher than the long-term annual average of 30 in. The maximum daily precipitation measurement of 1.7 in. occurred on August 9, 2011.

2.1.2.2 Water Quality

Stratification occurs in the lower Grasse River when colder water with higher specific conductivity (relative to the Grasse River water) from the St. Lawrence River enters into and moves upstream along the bottom of the lower Grasse River. Based on previous evaluations, differences of about 3 to 5 degrees Celsius (°C) in water temperature and about 20 micro Siemens per centimeter (µS/cm) in specific conductivity between the two water masses (i.e., 0.2 and 0.8 times the total water column depths) were used to identify the existence of stratification (**Figure 2-3**). Water temperature data showed the river was stratified at WC013 from early-June to early-August. Stratification was also observed at WC011 in mid-July and WC131 in late-June and mid-July. Similar patterns were generally observed in the specific conductivity data as well.

TSS levels measured throughout the river were generally low (**Figures 2-4a** and **2-4b**). At WCMSB, the average TSS concentration was 2.3 milligrams per liter (mg/L). Average TSS levels in the lower river were slightly higher, ranging from an average of 3.3 mg/L at WC013 and WC131 to 3.5 mg/L at WC011. The highest TSS concentration of 7.5 mg/L was observed at WC011 on June 2, 2011 (at an estimated flow of about 1,019 cfs).

2.1.2.3 PCBs

During review of the analytical data, the river sample collected during Round 2 (WC013-2 [0.8]) was flagged for having an unusually high total PCB concentration (115 nanograms per liter [ng/L]); all other samples contained PCB levels of non-detect to 7.6 ng/L). Upon closer review, the PCB congener patterns were found to be inconsistent with typical Grasse River samples. Although this Round 2 sample was not flagged by the laboratory, the atypical pattern suggests cross-contamination occurred at some indeterminable point. As a result, PCB congener data for this sample have been excluded from the discussion below, as well as associated tables and figures, and flagged in the water_iupac table of the database.

PCB concentrations measured at the Main Street Bridge were below detectable limits during all rounds in 2011, with the exception of a single detectable result of 0.9 ng/L, well within the range of levels typically expected due to atmospheric sources (Alcoa, April 2001). At the lower river locations, PCB concentrations were typically low, measuring below 30 ng/L throughout the year. As in past years, average PCB concentrations in the summer were higher than those in the spring and fall (**Figure 2-5**). PCB mass flux (i.e., the product of PCB concentration and river flow) was calculated to account for seasonal differences in river flow. Average PCB mass flux was highest in the summer (i.e., July) and slightly lower in the spring and fall months (**Figure 2-6**).

Water column PCB levels vary spatially in the lower Grasse River (**Figures 2-7a** and **2-7b**). During non-stratified periods (e.g., May, late-August, September, and October), PCB levels generally increase from upstream to downstream. During times when stratification was occurring (e.g., July and early-August), PCB concentrations were lowest at WCMSB (non-detect), peaked at WC131 or WC011, and declined at WC013. For example, average water column PCB concentrations on July 14 (Round 4) increased from non-detect at WCMSB (River

Mile [RM] 8.0) to 35 ng/L at WC131 (RM 4.6) and 23 ng/L at WC011 (RM 3.3), then declined downstream to about 7 ng/L at WC013 (RM 0.2). The decline in PCB levels between WC011 and WC013 is attributed to the dilution of Grasse River water with St. Lawrence River water. One exception to this was noted during Round 9 (October 25), where all field samples were reported below the detection limit.

PCB composition in water samples exhibits a spatial pattern in the spring, but this is not evident in other seasons. In the spring, the percentage of mono- and di-chlorinated biphenyls (CBs) decreases with distance downstream from about 7% to 0% and 47% to 24%, respectively, while the percentage of tri- and tetra-CBs increases from 42% to 52% and 5% to 23%, respectively (**Figure 2-8**). The samples collected in the summer show a similar PCB composition at all locations. Di- and tri-CBs dominate the PCB signature at about 40% to 50% and 30% to 40%, respectively. The remaining 10% to 20% is composed of tetra-CBs. In the fall, the PCB composition is primarily dominated by di- and tri-CBs (77% to 98%), with tetra-CBs making up the remaining PCB fraction.

2.1.2.4 Comparison to Historic Data

In general, water column PCBs measured in 2011 were similar to or lower than those measured over the past few years, and overall water column PCB concentrations have generally exhibited a decline over the period of record (i.e., 1995 to 2011; **Figures 2-9a** and 2-9**b**). These patterns also are evident in PCB mass flux (**Figures 2-10a** and **2-10b**). For example, average summer (July and August) PCB fluxes at WC131 have declined from about 400 to 500 grams per day (g/day) in 1996 to 1998 to 13 g/day in 2011. Similarly, average summer PCB fluxes at WC011 have declined from about 600 g/day to about 20 g/day over this same period (i.e., 1998 to 2011). Average flux levels measured in the spring and fall at WC131, the spring at WC013, and the spring at WC011 were the lowest on record. There are two exceptions at WC131 and WC011 during the summer months, where the average PCB flux is about 1.5 to 2 times higher than those observed between 2007 and 2010, although the overlapping error bars suggest no statistical difference. The higher average PCB flux in summer 2011 appears to be due to the combination of high flows relative to recent years, and elevated PCB concentrations measured during Round 4 (July 14) relative to the other summer time surveys (Rounds 5 and 6 in August).

2.2 RESIDENT FISH TREND MONITORING SURVEY

2.2.1 Monitoring Activities

The fall resident fish sampling was performed September 19 to 28, 2011, consistent with activities conducted in 2008 through 2010 as identified in the *2008 Routine Monitoring Activities Correspondence* and procedures identified in the *2005 Monitoring Program Work Plan* (Alcoa, March 2005). Sampling efforts were conducted in the Massena Power Canal, four stretches of the lower Grasse River (Background, Upper, Middle, and Lower), and the Grasse River mouth. The resident fish species targeted during this program were adult (greater than or equal to 25 centimeters [cm]) smallmouth bass (*Micropterus dolomieui*), adult (greater than or equal to 25 cm) brown bullhead (*Ictalurus nebulosus*), and young-of-year (YOY) (less than 6.5 cm) spottail shiner (*Notropis hudsonius*). Fish were collected using boat-mounted electrofishing equipment. A summary of the fish targeted and captured as part of this program is provided in **Table 2-4** and is further discussed below.

For the adult resident fish program, 17 adult smallmouth bass were collected from the Massena Power Canal, and 17 adult smallmouth bass and 18 adult brown bullhead were collected from each of the Upper, Middle, and Lower stretches of the river. Five adult smallmouth bass and five adult brown bullhead were collected from the Background Stretch. Of the five bullhead collected from background, one was smaller than 25 cm (23.1 cm). This fish was retained and submitted for analysis due to a lack of larger fish being available. Approximate adult smallmouth bass and brown bullhead collection locations are shown in **Figures 2-11** and **2-12**, respectively. The length and weight of each individual bass and bullhead collected are summarized in **Table 2-5**.

Three YOY spottail shiner composite samples were collected from each of four specific locations within the Study Area: near Outfall 001 (Upper Stretch); near the Unnamed Tributary (Middle Stretch); at the mouth of the river (downstream of the Lower Stretch); and within the

Background Stretch. Each whole-body composite sample contained between 17 and 23 fish. The minimum and maximum length of fish in each sample and the total weight of each sample are summarized in **Table 2-6**. Approximate spottail shiner collection locations are provided in **Figure 2-13**.

In total, 144 fish samples were packaged in the field and shipped to Pace for processing and analysis of PCB Aroclors and lipids in accordance with the procedures identified in the *2005 Monitoring Program Work Plan* (Alcoa, March 2005). These included 73 adult smallmouth bass fillets (skin-on, scales-off), 59 adult brown bullhead fillets (skin-off), and 12 YOY spottail shiner whole-body composite samples. QA/QC samples consisted of one MS/MSD sample per 20 samples collected, and were prepared by the laboratory from the submitted fish samples.

2.2.2 Summary of Results

2.2.2.1 PCB Results

Resident fish data from 2011 can be found on the attached CD-ROM (**Appendix A**) in the Access and EQuIS data table entitled resfish_aro. PCB results are also listed in **Tables 2-5** and **2-6** and are discussed below by species.

Smallmouth Bass

Average PCB concentrations for smallmouth bass are shown in the two left panels in **Figure 2-14**. Average lipid-normalized PCB concentrations are the highest in the Upper stretch (104 milligrams per kilogram [mg/kg] lipid) and decline with distance downstream to concentrations of 74 and 37 mg/kg lipid in the Middle and Lower Stretches, respectively. The average lipid-normalized PCB concentration in smallmouth bass from the Power Canal was 23 mg/kg lipid, which is about two to five times lower than those from the Grasse River proper. Lipid-normalized PCB levels were below detection in the Background Stretch (due to wet weight PCB levels that were reported below the detection limit).

On a wet-weight basis, PCB concentrations follow a similar spatial trend, with average concentrations of 0.9, 0.6, and 0.4 mg/kg in the Upper, Middle, and Lower Stretches, respectively. PCB levels were below the detection limit (about 0.05 mg/kg) in all five samples collected from the Background Stretch. The average wet-weight PCB concentration in smallmouth bass from the Power Canal was 0.1 mg/kg.

Brown Bullhead

Average PCB concentrations for brown bullhead are shown in the two middle panels in **Figure 2-14**. Lipid-normalized PCB levels were below detection in the Background Stretch (due to wet weight PCB levels that were reported below the detection limit). Average lipid-normalized PCB levels were highest in the Middle Stretch (65 mg/kg lipid), while those in the Upper Stretch and Lower Stretch were similar (54 and 51 mg/kg lipid, respectively). Statistical differences were not observed between the lower river sampling locations.

On a wet-weight basis, average PCB concentrations follow a similar trend as observed in the lipid-normalized PCBs; levels in the Upper, Middle, and Lower Stretches were 0.6, 1.0, and 0.7 mg.kg, respectively. PCB levels in brown bullhead samples were below the detection limit (about 0.05 mg/kg) in the Background Stretch.

YOY Spottail Shiner

Average PCB concentrations for YOY spottail shiner are shown in the two right panels in **Figure 2-14**. Average lipid-normalized PCB levels are the highest near Outfall 001 (77 mg/kg lipid) and decline moving downstream with concentrations of 29 and 18 mg/kg lipid near the Unnamed Tributary and at the River Mouth, respectively. Lipid-normalized PCB levels were below detection in the Background Stretch (due to wet weight PCB levels that were reported below the detection limit).

Average wet-weight PCB concentrations in YOY spottail shiner exhibited a similar pattern to those observed in the lipid-normalized PCBs; levels near Outfall 001, the Unnamed

Tributary, and at the River Mouth were 2.7, 1.3, and 0.9 mg/kg, respectively. Concentrations were below the detection limit (about 0.05 mg/kg) in the Background Stretch.

2.2.2.2 Comparison to Historic Data

Historic data for smallmouth bass are presented in **Figures 2-15** and **2-16**. Lipid-based PCB levels of smallmouth bass in 2011 are the lowest on record for all river locations. Smallmouth bass collected from the Massena Power Canal contain lipid-based PCB concentrations that are similar to those measured over the past several years. Overall, average lipid-based PCBs measured in smallmouth bass from the Upper Stretch have declined from about 1,470 mg/kg lipid during the mid-1990s to about 104 mg/kg lipid in 2011, representing a 93% decline over this period. Similarly, average lipid-based PCBs in smallmouth bass have declined from about 1,540 mg/kg lipid to about 74 mg/kg lipid in the Middle Stretch (representing a 95% decline) and about 1,350 mg/kg lipid to about 37 mg/kg lipid in the Lower Stretch (representing an 97% decline) over this same period (i.e., 1993 to 2011). Similar patterns were observed in PCB concentration on a wet-weight basis.

Historic data for brown bullhead are shown in **Figure 2-17**. For all river locations, average lipid-based PCB levels in 2011 are the lowest on record. Overall, average lipid-based PCBs in brown bullhead from the Upper Stretch have declined from about 660 mg/kg lipid during the early to mid-1990s to about 54 mg/kg lipid in 2011, representing a 92% decline over this period. Similarly, average lipid-based PCBs in brown bullhead have declined from about 890 mg/kg lipid to about 65 mg/kg lipid in the Middle Stretch (representing an 93% decline) and from about 820 mg/kg lipid to about 51 mg/kg lipid in the Lower Stretch (representing an 94% decline) over this same period (i.e., 1993 to 2011). Similar patterns were observed in PCB concentration on a wet-weight basis.

Historic data for YOY spottail shiner are presented in **Figure 2-18**.[1] Average wet-weight and lipid-based PCB levels near the River Mouth are similar to, or slightly lower than, levels measured over the past several years. Average lipid-based PCB levels near the Unnamed Tributary are the lowest on record (29 mg/kg lipid; 1998 to 2011). The one exception to the decline in lipid based PCB concentrations observed over the past several years is spottail shiner collected near Outfall 001. In this stretch, average concentrations in 2011 are about two times higher than those measured from 2008 through 2010; however, concentrations are within the upper range of levels measured since the 2005 ROPS activities. Similar patterns were observed in PCB concentration on a wet-weight basis.

Overall, average lipid-based PCBs in spottail shiner from near Outfall 001 have declined from about 150 mg/kg lipid in 1999 to about 77 mg/kg lipid in 2011, representing a 49% decline over this period. Average lipid-based PCBs in spottail shiner have declined from about 165 mg/kg lipid to 29 mg/kg lipid near the Unnamed Tributary (representing an 82% decline) and from about 36 mg/kg lipid to about 18 mg/kg lipid near the River Mouth (representing a 50% decline) over this same period (i.e., 1999 to 2011).

2.3 FIELD RECONNAISSANCE OF FISH ADVISORY SIGNS

2.3.1 Monitoring Activities

Thirteen fishing advisory signs were installed along the banks of the lower Grasse River in 2005. As requested by the USEPA and the New York State Department of Health (NYSDOH), annual field reconnaissance of these signs is conducted as part of the SRS Program to confirm the signs are in place and visible to the public. The 2011 field reconnaissance event was conducted on June 22, 2011, with activities performed in accordance with the *2008 Routine*

[1] Prior to 2001, YOY spottail shiners were not specifically targeted for collection; collection consisted of both adult and YOY spottail shiners. **Figure 2-18** includes composite samples of fish with a maximum length of 65 millimeters (mm), the current monitoring program's criterion for distinguishing between YOY and adult spottail shiners. Also, in 2001, two groups of spottail shiners were observed in the field; one group consisted of spottail shiners spawned in the spring and the other contained spottail shiners spawned in the late summer/fall. For proper comparison, only the results for the YOY spottail shiners spawned in the spring were considered.

Monitoring Activities Correspondence and the *2005 Monitoring Work Plan* (Alcoa, March 2005). The locations of the 13 signs are shown in **Figure 2-19**.

2.3.2 Summary of Results

All of the fishing advisory signs were visible from shore, and the majority of them were in good condition. Photographs documenting the condition of each sign were taken and are shown in **Figure 2-19**.

Notable observations included:

- Sign 1 – The sign was bent longitudinally down the middle and at the corners; however, the text and sign were still visible/legible.
- Sign 6 – The lower right corner of the sign was dent/bent; however, the text and sign were still visible/legible.

These observations are consistent with those recorded in 2010 (Alcoa, July 2011).

Table 2-1.
Summary of 2011 SRS Water Column Monitoring Activities

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Round #	Sampling Date	Additional Sampling Information
1	5/10/11	The temperature of one sample cooler was slightly elevated (8.8 degrees vs 4 degrees Celsius) upon arrival at the laboratory. The laboratory proceeded with analysis of the samples in the cooler, and the elevated temperature was noted.
2	6/2/11	The temperature of one sample cooler was slightly elevated (8.2 degrees vs 4 degrees Celsius) upon arrival at the laboratory. The laboratory proceeded with analysis of the samples in the cooler, and the elevated temperature was noted.
3	6/22/11	--
4	7/14/11	--
5	8/2/11	--
6	8/25/11	--
7	9/14/11	--
8	10/3/11	--
9	10/25/11	--

Notes:
1. SRS = Supplemental Remedial Studies
2. -- Not Applicable

Table 2-2.
2011 SRS Water Column Monitoring Activites
PCB Results

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Round	Date	Flow[4] [cfs]	Mean Temperature[5] [deg C]	Mean Conductivity[5] [µS/cm]	Fraction of Total Water Depth[6]	Total PCBs [ng/L] [7,8,9] WCMSB	WC131	WC011	WC013
1	May 10	1,671	14.1	101	0.2	ND	ND	2.4 (ND)	4.6
					0.8		ND	0.2	6.6
2	June 2	1,019	22.0	103	0.2	ND	ND	4.9 (ND)	7.6
					0.8		ND	5.3	---[10]
3	June 22	366	23.9	138	0.2	ND	7.1 (ND)	7.0	9.0
					0.8		27.0	21.3	ND
4	July 14	773	25.4	127	0.2	ND	15.3	20.4	14.5
					0.8		55.5	28.2 (22.8)	ND
5	August 2	719	26.2	92	0.2	ND	2.9	4.9	14.5 (8.4)
					0.8		5.5	4.1	15.0
6	August 25	528	22.0	99	0.2	ND	3.7 (6.4)	9.6	16.3
					0.8		3.2	10.9	14.7
7	September 14	513	20.7	102	0.2	0.9 (ND)	3.1	2.5	8.5
					0.8		ND	2.4	5.9
8	October 3	812	14.8	88	0.2	ND	ND (ND)	3.8	16.6
					0.8		ND	3.5	22.8
9	October 25	1,159	10.0	69	0.2	ND	ND	ND (ND)	ND
					0.8		ND	ND	ND

Notes:
1. Duplicate values in parentheses.
2. All samples unfiltered.
3. Units: cfs = cubic feet per second; deg C = degrees Celsius; µS/cm = micro-Siemens per centimeter; ng/L = nanogram per liter.
4. Daily average flows are calculated from records at the USGS gage at Chase Mills.
5. Mean excludes transects where stratification was observed.
6. Water samples at WCMSB collected at 0.5*total water depth.
7. Locations shown on Figure 2-1.
8. ND = 'Not Detected'; concentrations of all PCB congeners were reported as non-detect (less than the per congener method detection limit [MDL] of 0.2 ng/L).
9. The total PCB concentration reported by the laboratory is the sum of all congener concentrations above the MDL.
10. Total PCB results for sample WC013-2 (0.8) have been excluded due to possible cross-contamination.

Table 2-3.
2011 SRS Water Column Monitoring Activites
Total Suspended Solids Results

2011 SRS Data Summary Report
Grasse River Study Area, Massena, New York

Round	Date	Flow[4] [cfs]	Mean Temperature[5] [deg C]	Mean Conductivity[5] [µS/cm]	Fraction of Total Water Depth[6]	Total Suspended Solids [mg/L][7,8] WCMSB	WC131	WC011	WC013
1	May 10	1,671	14.1	101	0.2	4.2	5.3	4.2 (4.7)	5.1
					0.8		6.9	4.0	6.1
2	June 2	1,019	22.0	103	0.2	5.1	5.1	6.9 (6.8)	5.0
					0.8		5.2	7.5	3.9
3	June 22	366	23.9	138	0.2	1.5	3.2 (2.8)	3.3	3.2
					0.8		3.8	4.0	2.8
4	July 14	773	25.4	127	0.2	2.6	2.7	3.5	3.4
					0.8		4.5	3.4 (3.9)	2.5
5	August 2	719	26.2	92	0.2	1.3	1.8	2.8	1.9 (1.8)
					0.8		3.3	2.2	2.0
6	August 25	528	22.0	99	0.2	1.6	2.9 (3.3)	3.4	4.5
					0.8		2.6	3.4	3.6
7	September 14	513	20.7	102	0.2	1.4 (1.4)	3.7	1.8	2.1
					0.8		1.3	3.7	3.0
8	October 3	812	14.8	88	0.2	ND	1.4 (1.1)	1.7	2.5
					0.8		ND	1.9	2.7
9	October 25	1,159	10.0	69	0.2	2.8	2.3	2.7 (2.4)	3.7
					0.8		2.8	2.9	1.7

Notes:
1. Duplicate values in parentheses.
2. All samples unfiltered.
3. Units: cfs = cubic feet per second; deg C = degrees Celsius; µS/cm = microSiemens per centimeter; mg/L = milligrams per liter.
4. Daily average flows are calculated from records at the USGS gage at Chase Mills.
5. Mean excludes transects where stratification was observed.
6. Water samples at WCMSB collected at 0.5*total water depth.
7. ND = 'Not Detected'; sample concentration was below the detection limit (approximately 1.0 mg/L).
8. Locations shown on Figure 2-1.

Table 2-4.
Number of Resident Fish Samples Collected/Number of Samples Targeted

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Resident Fish Species	Grasse River Stretch Number of Samples Collected/Number of Samples Targeted				
	Background	Upper	Middle	Lower	Power Canal
Adult Smallmouth Bass	5 / 5	17 / 17	17 / 17	17 / 17	17 / 17
Adult Brown Bullhead	5 / 5	18 / 18	18 / 18	18 / 18	not targeted

Resident Fish Species	Grasse River Location Number of Samples Collected/Number of Samples Targeted			
	Background	Near Outfall 001	Near Unnamed Tributary	Mouth of River
Young-of-Year Spottail Shiner	3 / 3	3 / 3	3 / 3	3 / 3

Note:
1. Samples were collected from September 19 through September 28, 2011.

Table 2-5.
Adult Resident Fish Collection Field and Laboratory Data - Smallmouth Bass and Brown Bullhead

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Sample Area	Species	Sample ID	Date Collected	Length (cm)	Weight (g)	Lipid (%)	PCB (mg/kg wet)	PCB (mg/kg lipid)
Background Stretch	Smallmouth bass	FS1-904-SB	9/19/11	31.3	376	0.51	ND	5
		FS1-905-SB	9/19/11	35.4	734	0.90	ND	3
		FS1-906-SB	9/19/11	37.6	735	0.97	ND	3
		FS1-907-SB	9/19/11	26.7	260	0.64	ND	4
		FS1-908-SB	9/19/11	41.7	1196	1.29	ND	2
	Brown bullhead	FS1-911-BB	9/19/11	30.9	382	1.61	ND	2
		FS1-912-BB	9/19/11	29.0	315	1.24	ND	2
		FS1-913-BB	9/19/11	23.1	186	2.40	ND	1
		FS1-1043-BB	9/28/11	26.0	229	1.04	ND	2
		FS1-1044-BB	9/28/11	27.5	286	1.28	ND	2
Upper Stretch	Smallmouth bass	FS2-955-SB	9/20/11	39.3	1054	1.58	0.31	19
		FS2-956-SB	9/20/11	35.4	671	1.11	0.15	14
		FS2-957-SB	9/20/11	25.3	237	0.90	1.90	210
		FS2-958-SB	9/20/11	28.2	267	1.01	0.25	25
		FS2-959-SB	9/20/11	35.0	581	0.96	0.46	48
		FS2-960-SB	9/20/11	27.6	267	0.80	1.01	126
		FS2-961-SB	9/20/11	27.6	269	1.07	1.24	116
		FS2-962-SB	9/20/11	30.7	390	1.02	1.74	170
		FS2-963-SB	9/20/11	30.8	412	0.63	2.07	327
		FS2-964-SB	9/20/11	33.1	504	1.04	0.45	44
		FS2-965-SB	9/20/11	35.2	588	0.80	1.12	140
		FS2-966-SB	9/20/11	30.0	338	0.65	0.73	112
		FS2-967-SB	9/20/11	38.5	854	1.02	1.74	170
		FS2-968-SB	9/20/11	40.3	1094	1.69	0.76	45
		FS2-969-SB	9/20/11	30.4	382	0.37	0.23	62
		FS2-970-SB	9/20/11	29.2	349	0.66	0.36	55
		FS2-971-SB	9/20/11	33.3	524	0.78	0.63	82
	Brown bullhead	FS2-914-BB	9/20/11	31.2	507	1.70	0.79	47
		FS2-915-BB	9/20/11	33.5	563	0.65	0.74	114
		FS2-916-BB	9/20/11	33.2	509	1.32	0.76	58
		FS2-917-BB	9/20/11	32.4	497	0.76	0.13	17
		FS2-918-BB	9/20/11	34.6	532	1.02	0.74	73
		FS2-919-BB	9/20/11	35.1	721	2.00	0.63	31
		FS2-920-BB	9/20/11	36.2	704	1.72	0.86	50
		FS2-921-BB	9/20/11	31.3	416	0.88	0.26	30
		FS2-922-BB	9/20/11	31.3	463	0.65	0.48	73
		FS2-923-BB	9/20/11	32.1	410	1.02	0.07	7
		FS2-924-BB	9/20/11	34.5	596	0.82	0.23	29
		FS2-925-BB	9/20/11	30.7	420	0.81	0.45	56
		FS2-926-BB	9/20/11	35.2	700	1.19	1.43	120
		FS2-927-BB	9/20/11	31.7	443	0.78	0.21	27
		FS2-928-BB	9/20/11	33.5	524	1.56	1.25	80
		FS2-929-BB	9/20/11	31.5	423	1.25	0.30	24
		FS2-930-BB	9/20/11	34.2	582	1.49	1.10	74
		FS2-931-BB	9/20/11	33.5	611	1.03	0.58	57
Middle Stretch	Smallmouth bass	FS3-989-SB	9/23/11	33.0	494	0.84	0.86	102
		FS3-990-SB	9/23/11	25.2	232	0.73	0.95	130
		FS3-991-SB	9/23/11	31.7	504	0.83	0.72	88
		FS3-992-SB	9/23/11	28.0	343	0.92	0.56	61

Table 2-5.
Adult Resident Fish Collection Field and Laboratory Data - Smallmouth Bass and Brown Bullhead

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Sample Area	Species	Sample ID	Date Collected	Length (cm)	Weight (g)	Lipid (%)	PCB (mg/kg wet)	PCB (mg/kg lipid)
Middle Stretch (continued)	Smallmouth bass	FS3-993-SB	9/23/11	32.9	537	0.75	0.40	53
		FS3-994-SB	9/23/11	26.1	265	0.74	1.01	136
		FS3-995-SB	9/23/11	29.8	428	1.87	0.48	26
		FS3-996-SB	9/23/11	27.0	291	0.64	0.48	76
		FS3-997-SB	9/23/11	39.7	1007	1.35	0.09	7
		FS3-998-SB	9/23/11	31.7	495	0.59	0.76	128
		FS3-999-SB	9/23/11	41.7	1240	1.15	ND	2
		FS3-1000-SB	9/23/11	37.2	746	0.78	0.68	87
		FS3-1001-SB	9/23/11	29.2	363	0.59	0.77	132
		FS3-1002-SB	9/23/11	31.1	460	0.70	0.70	99
		FS3-1003-SB	9/23/11	32.5	544	1.04	0.05	5
		FS3-1004-SB	9/23/11	27.7	335	0.85	0.72	84
		FS3-1005-SB	9/23/11	33.5	597	0.58	0.29	50
	Brown bullhead	FS3-1006-BB	9/23/11	32.0	437	2.21	1.01	46
		FS3-1007-BB	9/23/11	30.8	369	1.57	0.54	34
		FS3-1008-BB	9/23/11	33.9	501	1.44	0.65	45
		FS3-1009-BB	9/23/11	34.1	625	2.02	1.24	62
		FS3-1010-BB	9/23/11	29.3	331	1.09	0.46	42
		FS3-1011-BB	9/23/11	31.5	455	1.23	0.57	46
		FS3-1012-BB	9/23/11	29.2	342	1.25	0.32	26
		FS3-1013-BB	9/23/11	26.0	223	1.10	1.11	101
		FS3-1014-BB	9/23/11	36.6	774	2.31	1.81	78
		FS3-1015-BB	9/23/11	34.0	578	1.44	1.76	122
		FS3-1016-BB	9/23/11	35.2	724	1.31	2.08	159
		FS3-1017-BB	9/23/11	28.0	272	1.44	0.34	24
		FS3-1018-BB	9/23/11	33.2	487	1.50	0.85	57
		FS3-1019-BB	9/23/11	33.8	541	1.13	0.75	66
		FS3-1020-BB	9/23/11	33.2	522	1.81	0.72	40
		FS3-1021-BB	9/23/11	32.7	490	1.56	1.20	77
		FS3-1022-BB	9/23/11	35.2	675	2.40	1.46	61
		FS3-1023-BB	9/23/11	31.7	475	1.55	1.19	77
Lower Stretch	Smallmouth bass	FS4-950-SB	9/20/11	39.8	1076	2.79	0.73	26
		FS4-951-SB	9/20/11	30.3	439	0.81	0.61	75
		FS4-952-SB	9/20/11	37.0	847	1.08	1.02	94
		FS4-953-SB	9/20/11	36.8	738	1.00	1.02	102
		FS4-1029-SB	9/28/11	35.5	768	1.46	0.27	19
		FS4-1030-SB	9/28/11	26.3	275	1.10	ND	2
		FS4-1031-SB	9/28/11	39.1	970	2.66	0.44	17
		FS4-1032-SB	9/28/11	41.2	1237	2.21	ND	1
		FS4-1033-SB	9/28/11	32.5	431	0.70	0.29	41
		FS4-1034-SB	9/27/11	25.3	263	0.54	0.37	69
		FS4-1035-SB	9/27/11	41.9	1217	2.20	0.62	28
		FS4-1036-SB	9/27/11	40.4	1204	2.15	0.40	19
		FS4-1037-SB	9/27/11	40.2	1112	2.14	0.06	3
		FS4-1038-SB	9/27/11	38.7	1095	2.14	0.07	3
		FS4-1039-SB	9/27/11	33.0	588	0.83	0.92	110
		FS4-1040-SB	9/27/11	36.4	938	1.30	0.15	12
		FS4-1041-SB	9/27/11	26.0	278	0.73	ND	3

Table 2-5.
Adult Resident Fish Collection Field and Laboratory Data - Smallmouth Bass and Brown Bullhead

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Sample Area	Species	Sample ID	Date Collected	Length (cm)	Weight (g)	Lipid (%)	PCB (mg/kg wet)	PCB (mg/kg lipid)
Lower Stretch (continued)	Brown bullhead	FS4-932-BB	9/20/11	34.9	634	1.34	0.49	37
		FS4-933-BB	9/20/11	34.0	641	1.23	0.80	65
		FS4-934-BB	9/20/11	33.3	560	1.45	0.49	34
		FS4-935-BB	9/20/11	37.4	795	0.90	1.01	112
		FS4-936-BB	9/20/11	33.7	646	1.52	0.52	34
		FS4-937-BB	9/20/11	30.0	396	0.82	ND	3
		FS4-938-BB	9/20/11	37.0	815	1.43	0.60	42
		FS4-939-BB	9/20/11	33.9	585	0.85	0.33	39
		FS4-940-BB	9/20/11	29.2	356	0.81	0.33	40
		FS4-941-BB	9/20/11	29.1	346	1.24	0.30	24
		FS4-942-BB	9/20/11	33.2	556	0.99	0.24	24
		FS4-943-BB	9/20/11	32.1	544	1.81	2.07	114
		FS4-944-BB	9/20/11	35.3	694	1.20	0.92	77
		FS4-945-BB	9/20/11	33.4	623	1.30	0.58	44
		FS4-946-BB	9/20/11	34.7	747	1.54	0.77	50
		FS4-947-BB	9/20/11	36.0	742	1.38	0.67	48
		FS4-948-BB	9/20/11	32.6	551	1.32	1.02	77
		FS4-949-BB	9/20/11	36.1	634	1.84	0.95	52
Power Canal	Smallmouth bass	FS6-972-SB	9/21/11	31.9	465	0.64	0.29	45
		FS6-973-SB	9/21/11	28.7	306	0.81	0.16	20
		FS6-974-SB	9/21/11	29.6	308	0.46	0.11	25
		FS6-975-SB	9/21/11	40.7	900	1.76	0.40	23
		FS6-976-SB	9/21/11	30.0	347	0.61	0.05	9
		FS6-977-SB	9/21/11	27.2	228	0.65	0.34	52
		FS6-978-SB	9/21/11	36.8	747	0.82	0.15	19
		FS6-979-SB	9/21/11	39.3	927	0.95	0.08	9
		FS6-980-SB	9/21/11	39.5	940	0.82	0.07	9
		FS6-981-SB	9/21/11	41.7	834	0.35	0.30	87
		FS6-982-SB	9/21/11	36.3	596	0.34	0.06	18
		FS6-983-SB	9/21/11	32.0	350	0.35	ND	7
		FS6-984-SB	9/21/11	27.9	229	0.46	0.15	33
		FS6-985-SB	9/21/11	27.2	250	0.68	0.06	9
		FS6-986-SB	9/21/11	27.0	251	0.94	0.17	18
		FS6-987-SB	9/21/11	26.3	219	0.69	0.06	9
		FS6-988-SB	9/21/11	27.6	287	0.53	ND	5

Notes:
1. Units: cm = centimeter, g = gram, mg/kg = milligrams per kilogram
2. ND = not detected; The detection limit is approximately 0.05 mg/kg for non-detected samples.
3. PCB concentrations quantified on an Aroclor basis.
4. If PCB concentration was not detected, PCB concentration on a wet weight basis was set to half the detection limit prior to computing PCB concentration on a lipid basis
5. Smallmouth bass fillets - skin-on, scales-off; brown bullhead fillets - skin-off.
6. Sampling locations shown on Figures 2-11 and 2-12.

Table 2-6.
Resident Fish Collection Field and Laboratory Data - Young-of-Year Spottail Shiner

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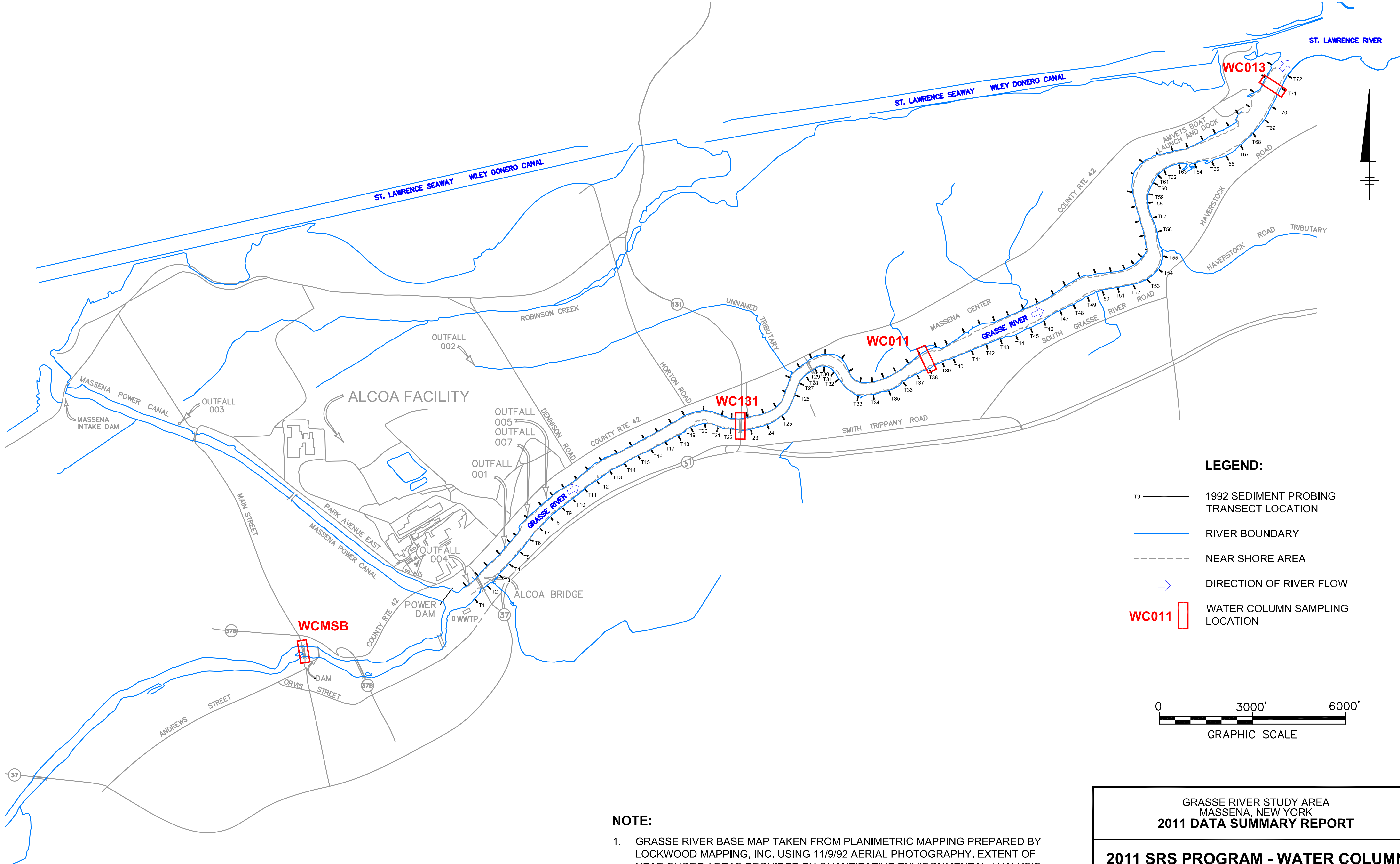
Grasse River Study Area, Massena, New York

Species	Sample Area	Sample ID	Date Collected	Fish per Sample	Length Range (cm)	Weight (g)	Lipid (%)	PCB (mg/kg wet)	PCB (mg/kg lipid)
Spottail Shiner	Background Stretch	FS1-901-SS	9/19/11	23	4.6 - 6.0	26	3.86	ND	0.6
		FS1-902-SS	9/19/11	23	4.4 - 5.9	28	4.09	ND	0.6
		FS1-903-SS	9/19/11	23	4.8 - 6.0	28	4.21	ND	0.6
	Outfall 001 (Upper Stretch)	FS2-888-SS	9/20/11	21	4.6 - 5.9	21	3.56	2.40	67.4
		FS2-889-SS	9/20/11	21	4.4 - 6.0	23	3.73	2.71	72.7
		FS2-890-SS	9/20/11	21	4.6 - 5.8	21	3.31	3.00	90.6
	Unnamed Tributary (Middle Stretch)	FS3-1045-SS	9/28/11	18	4.8 - 6.0	18	3.81	1.13	29.6
		FS3-1046-SS	9/28/11	18	4.7 - 6.0	19	5.01	1.27	25.4
		FS3-1047-SS	9/28/11	17	5.0 - 5.9	18	4.58	1.49	32.4
	Grasse River Mouth (Lower Stretch)	FS5-1048-SS	9/28/11	19	4.1 - 6.0	21	4.65	0.84	18.2
		FS5-1049-SS	9/28/11	19	5.2 - 5.8	23	4.52	0.75	16.6
		FS5-1050-SS	9/28/11	19	4.2 - 6.0	23	5.17	0.99	19.1

Notes:
1. Units: cm = centimeters, g = grams, mg/kg = milligrams per kilogram
2. ND = not detected; PCB concentrations quantified on an Aroclor basis.
3. If PCB concentration was not detected, PCB concentration on a wet weight basis was set to half the detection limit prior to computing PCB concentration on a lipid basis.
4. Spottail shiner - whole-body composites.
5. Sampling locations shown on Figure 2-13.



NOTE:

1. GRASSE RIVER BASE MAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA). ST. LAWRENCE RIVER WATERLINE GENERATED USING 5/1/01 AERIAL PHOTOGRAPHY.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
2011 DATA SUMMARY REPORT

2011 SRS PROGRAM - WATER COLUMN MONITORING LOCATIONS

ALCOA

2-1

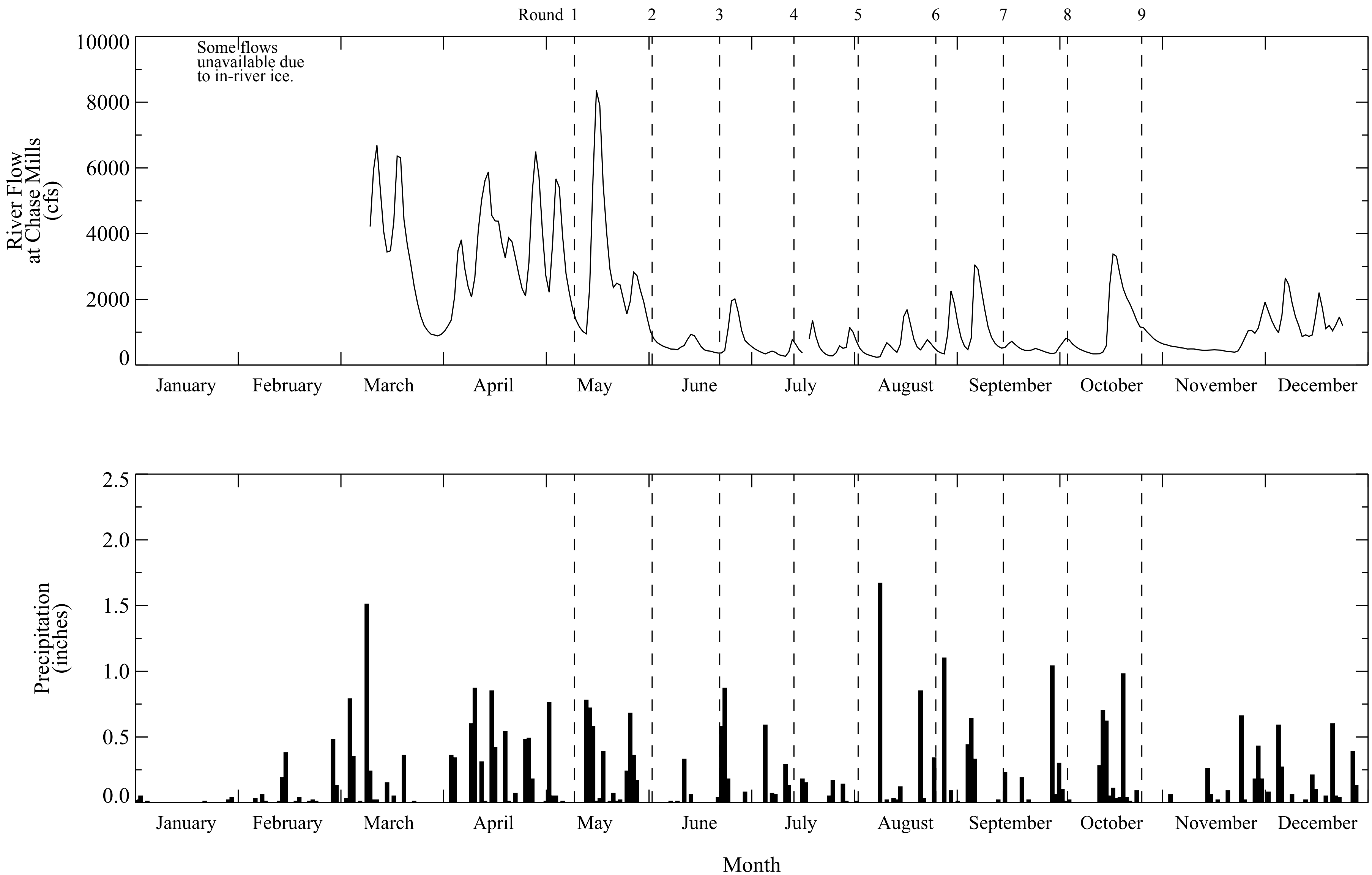


Figure 2-2. Grasse River Flow and Precipitation Information from 2011

Grasse River flow based on daily averages of flow records from the USGS gage at Chase Mills.
Grasse River precipitation measured near Outfall 007.

Data tables: climate, riverflow_chasemills, water_iupac

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Mon May 14 12:22:43 2012

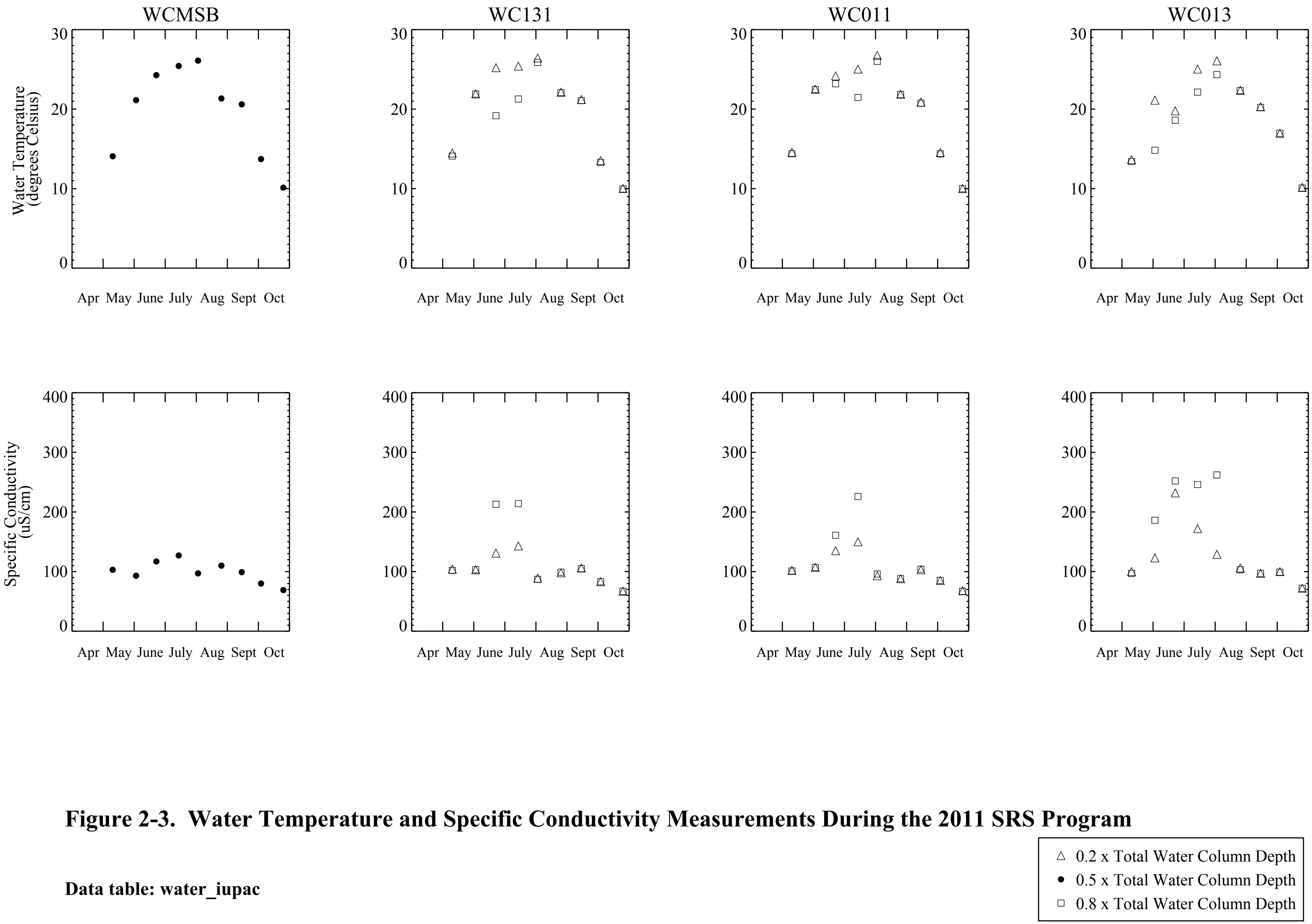

Figure 2-3. Water Temperature and Specific Conductivity Measurements During the 2011 SRS Program

Data table: water_iupac

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Wed Apr 25 15:50:27 2012

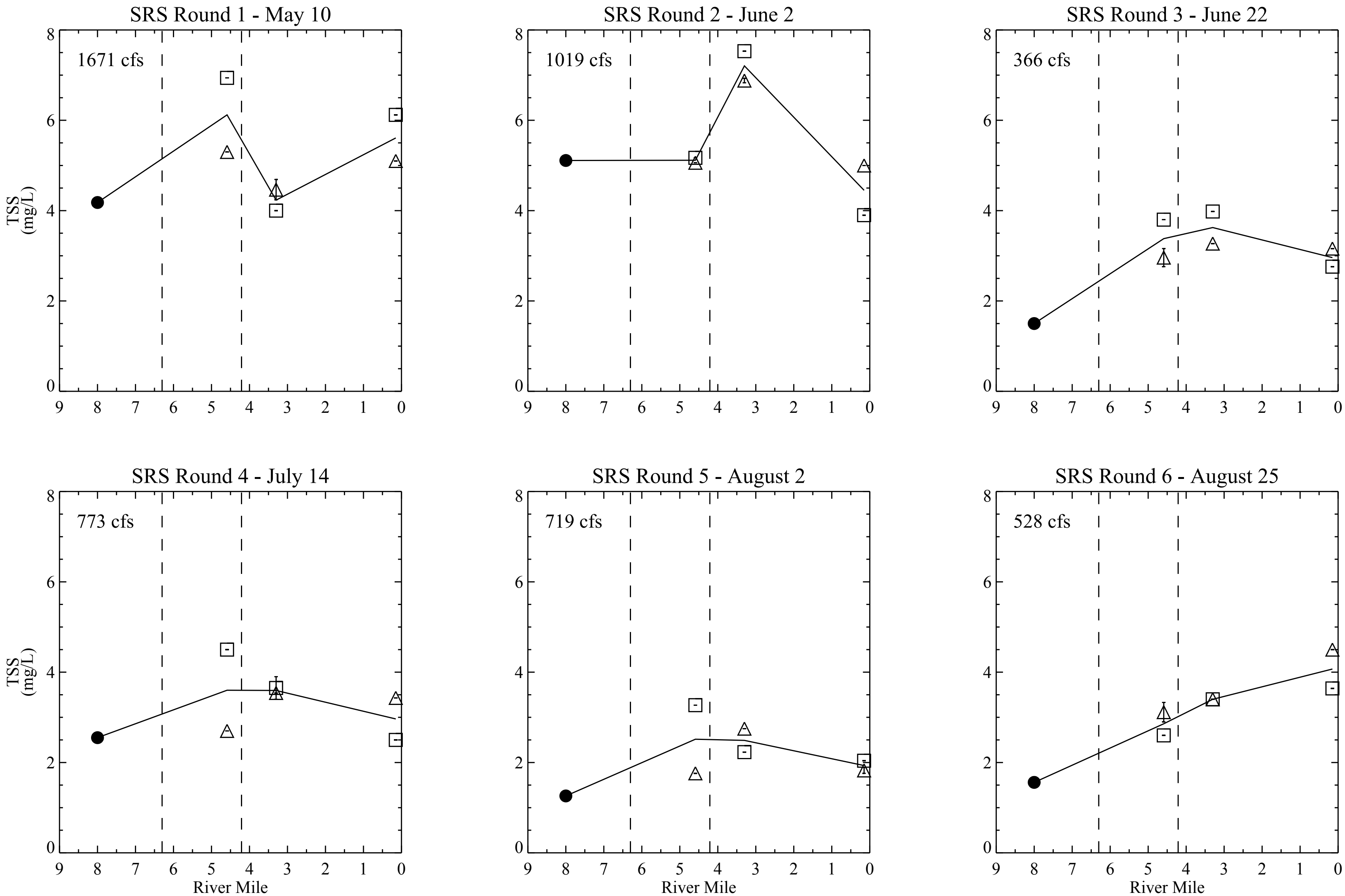

Figure 2-4a. Spatial Distribution of TSS Concentrations Measured During the 2011 SRS Program (Rounds 1-6)

Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).
Daily average flows indicated in upper left corner. Flows measured at the USGS gage at Chase Mills.
Values below the detection limit set to half the detection limit. Duplicates averaged (error bar represents range).
Data tables: riverflow_ChaseMills, water_iupac

△ 0.2 x Total Water Column Depth
● 0.5 x Total Water Column Depth
□ 0.8 x Total Water Column Depth

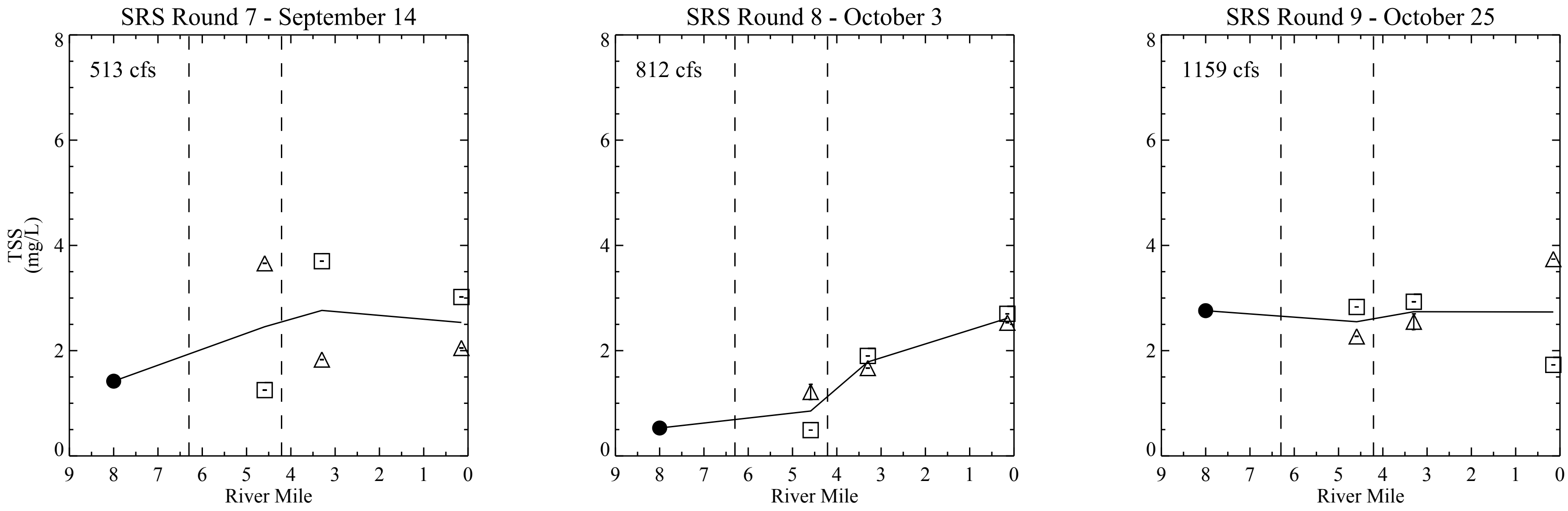

Figure 2-4b. Spatial Distribution of TSS Concentrations Measured During the 2011 SRS Program (Rounds 7-9)
Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).
Daily average flows indicated in upper left corner. Flows measured at the USGS gage at Chase Mills.
Values below the detection limit set to half the detection limit. Duplicates averaged (error bar represents range).
Data tables: riverflow_ChaseMills, water_iupac

△ 0.2 x Total Water Column Depth
• 0.5 x Total Water Column Depth
□ 0.8 x Total Water Column Depth

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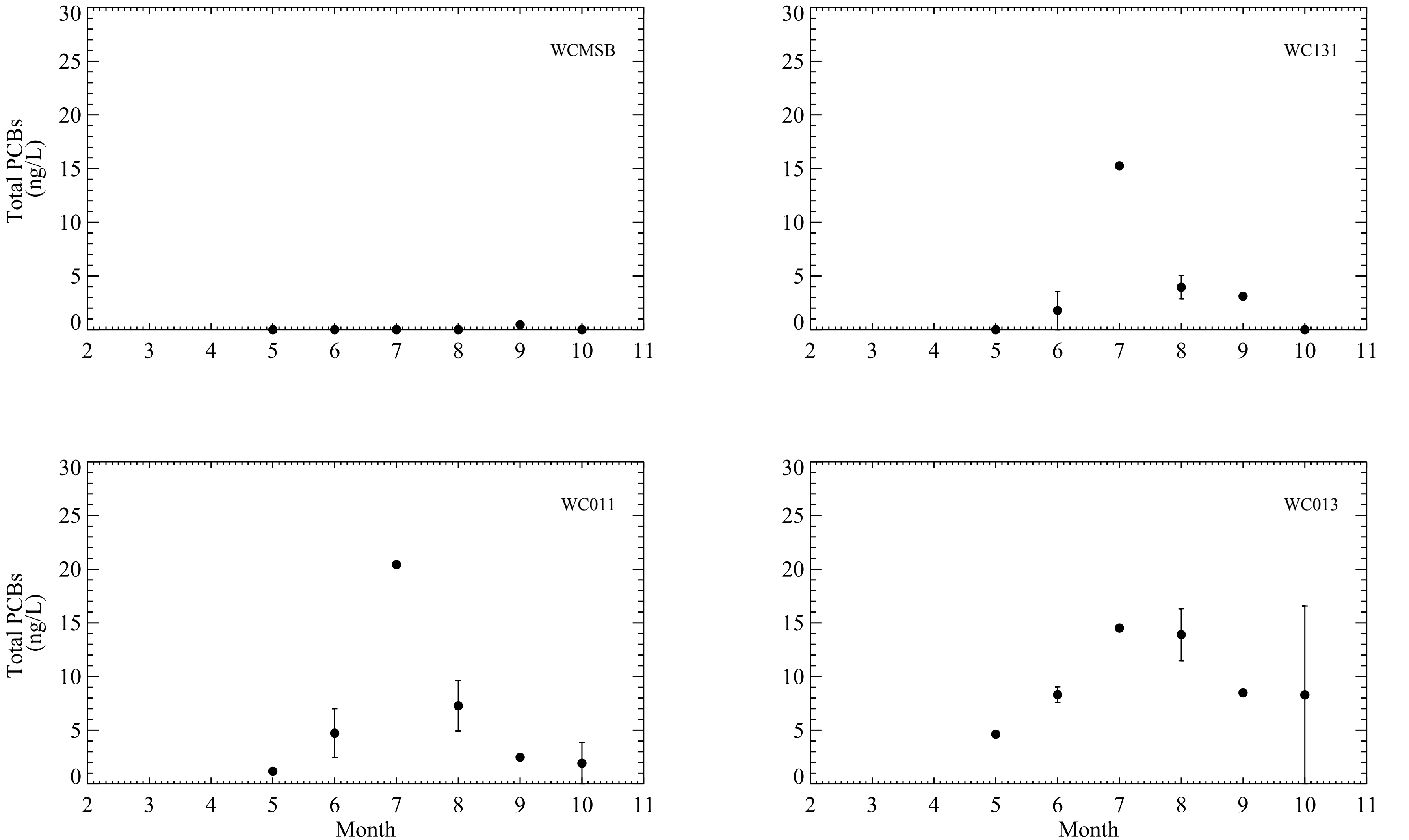

Figure 2-5. Monthly Average PCB Concentrations at Water Column Sampling Locations in 2011

Data represent surface samples collected at 0.2 times the total water depth (0.5 x depth for WCMSB) to avoid any influence of stratification.
Error bars represent range of means and are only shown for months with multiple sampling events.
Duplicates averaged with original sample.
Data table: water_iupac

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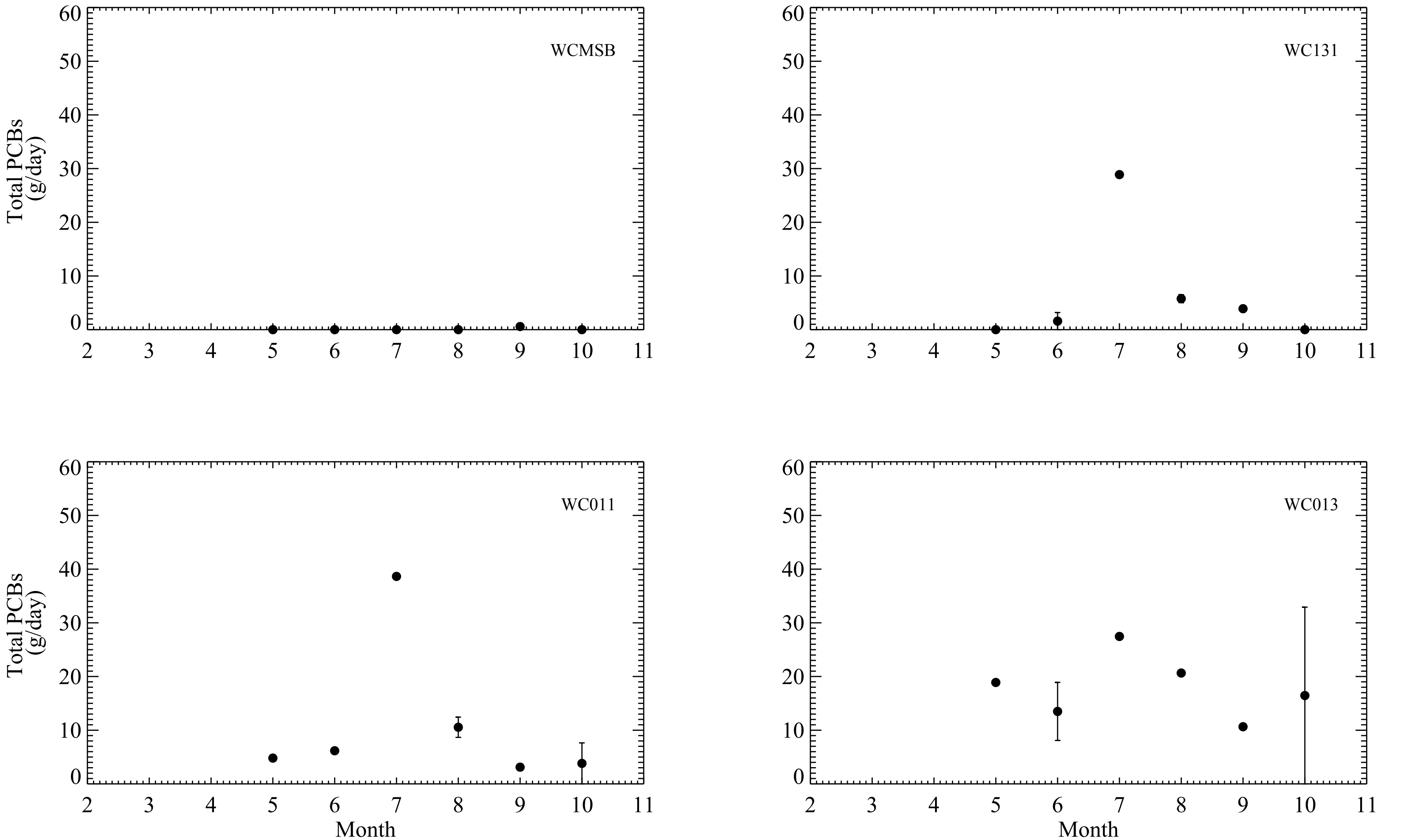


Figure 2-6. Monthly Average PCB Mass Fluxes at Water Column Sampling Locations in 2011

Data represent surface samples collected at 0.2 times the total water depth (0.5 x depth for WCMSB) to avoid any influence of stratification.

Error bars represent range of means and are only shown for months with multiple sampling events.

Duplicates averaged with original sample.

Data tables: riverflow_ChaseMills, water_iupac

ARC - C:\Jobs\ALCgra\Analysis\Water\srs\monthly_avg_pcb.pro
Fri May 25 13:19:27 2012

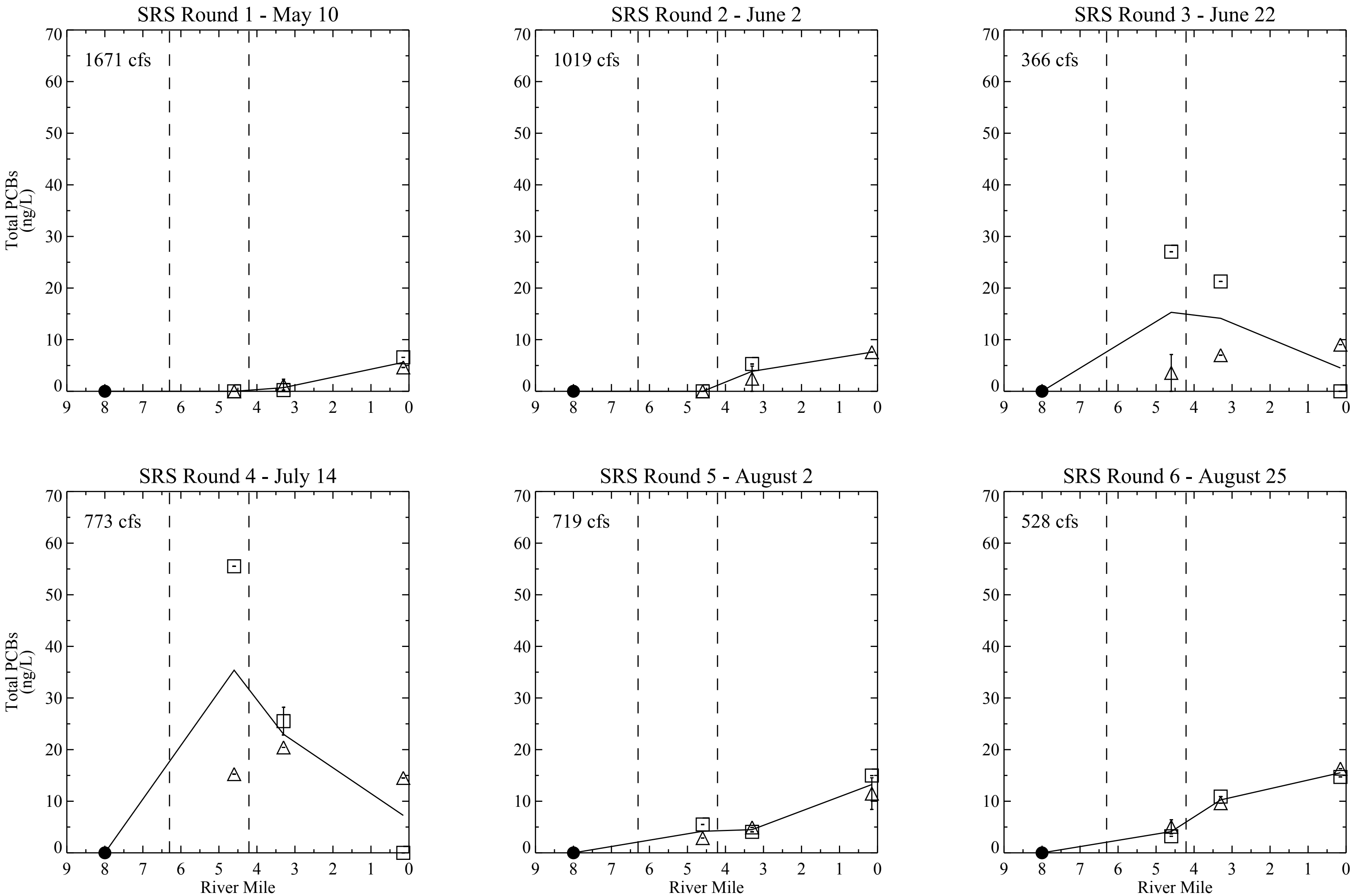


Figure 2-7a. Spatial Distribution of Total PCBs in Water Samples Collected During the 2011 SRS Program (Rounds 1-6)

Values represent unfiltered water column sample results. Duplicates averaged (error bar represents range).
Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).
Estimated daily average flows indicated in upper left corner. Flows measured at the USGS gage at Chase Mills.

△ 0.2 x Total Water Column Depth
● 0.5 x Total Water Column Depth
□ 0.8 x Total Water Column Depth

Data tables: riverflow_ChaseMills, water_iupac

ARC - C:\Jobs\ALCgra\Analysis\Water\srs\all_rounds_tpcb_conc_spat.pro
Fri May 11 15:14:03 2012

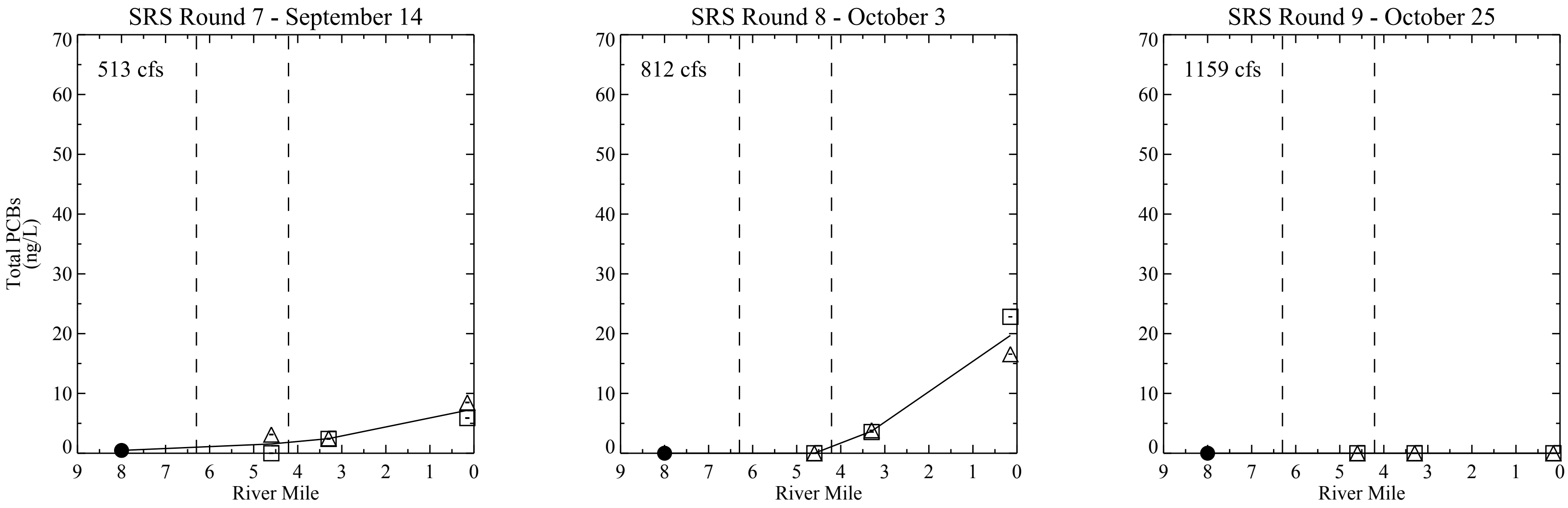


Figure 2-7b. Spatial Distribution of Total PCBs in Water Samples Collected During the 2011 SRS Program (Rounds 7-9)

Values represent unfiltered water column sample results. Duplicates averaged (error bar represents range).
Vertical dashed lines represent approximate locations of Outfall 001 (left) and the Unnamed Tributary (right).
Estimated daily average flows indicated in upper left corner. Flows measured at the USGS gage at Chase Mills.

△ 0.2 x Total Water Column Depth
• 0.5 x Total Water Column Depth
□ 0.8 x Total Water Column Depth

Data tables: riverflow_ChaseMills, water_iupac

ARC - C:\Jobs\ALCgra\Analysis\Water\srs\all_rounds_tpcb_conc_spat.pro
Fri May 11 15:14:03 2012

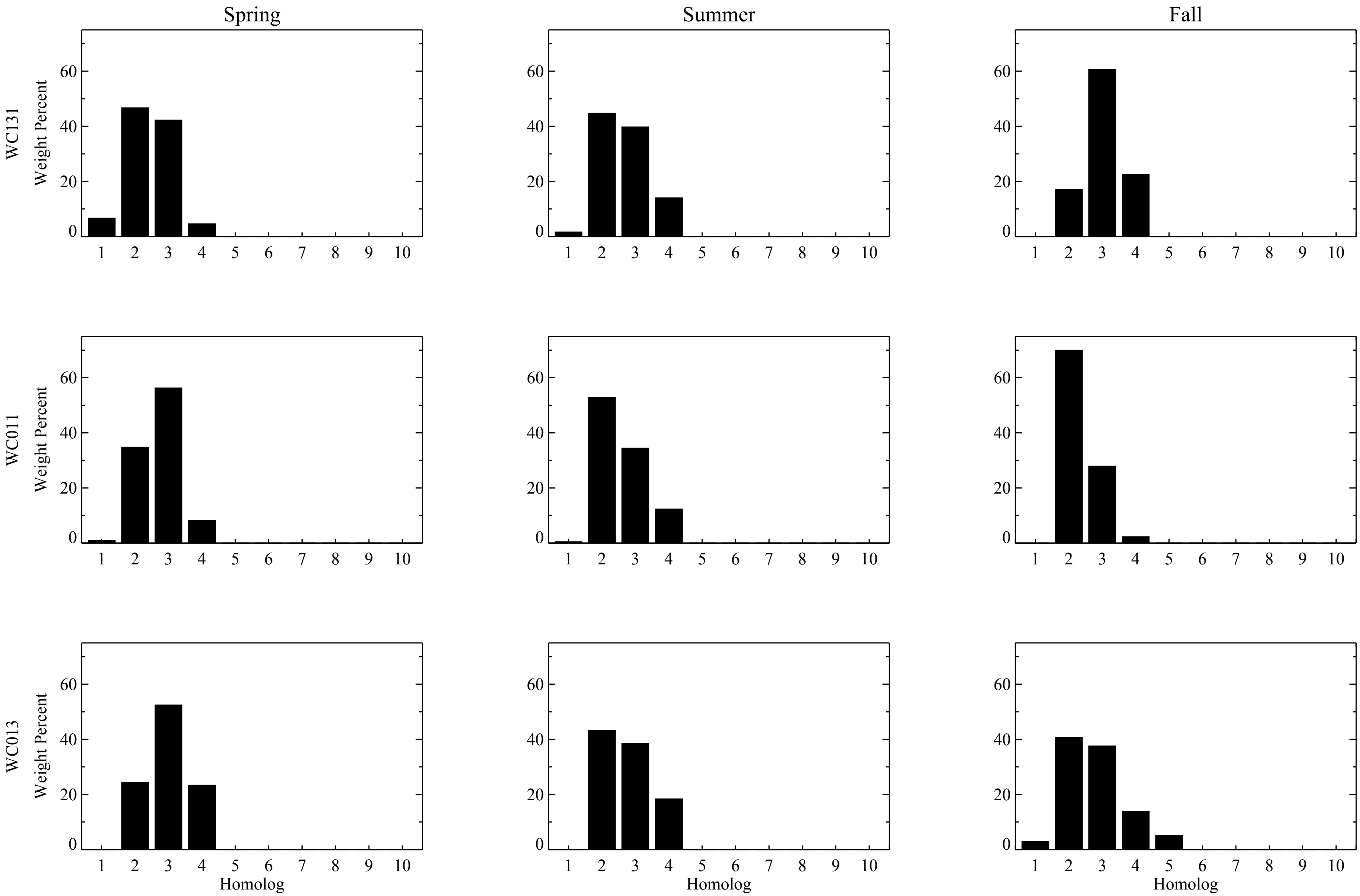


Figure 2-8. Average Homolog Distributions in Water Samples Collected in 2011
Spring - April, May, & June; Summer - July & August; Fall - September & October
Bars represent average water column results at each location for each season.

Data table: water_iupac

ARC - C:\Jobs\ALCgra\Analysis\Water\srs\seasonal_avghom.pro
Mon Apr 30 16:21:53 2012

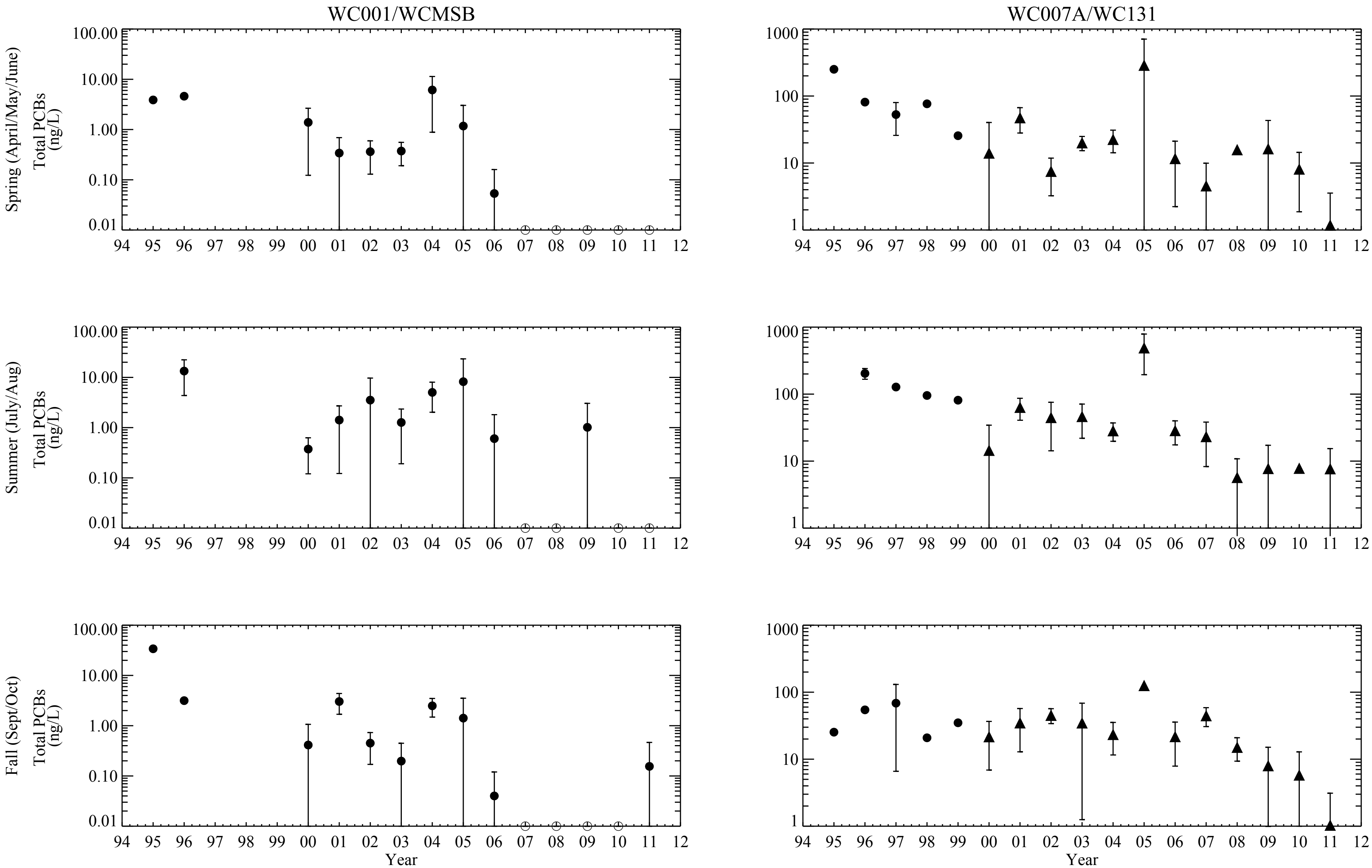


Figure 2-9a. Seasonal Average Water Column PCB Concentrations Measured During Non-Stratified Periods (WC001/WCMSB and WC007A/WC131)

Data represent samples collected when river flow was less than or equal to 2200 cfs. Triangles represent surface samples collected at WC131.
1995 to 1999 data represent composite samples collected during non-stratified periods.
2000 to 2010 data represent surface samples collected at 0.2 times the total water depth to avoid any influence of stratification.
Error bars represent two standard errors of the mean; no error bars shown if sample count is fewer than three.
Duplicates averaged; data collected on same day averaged. Non-detects are plotted at 0.01 ng/L as open circles.
Data tables: riverflow_hist, water_bz, water_peak, water_iupac

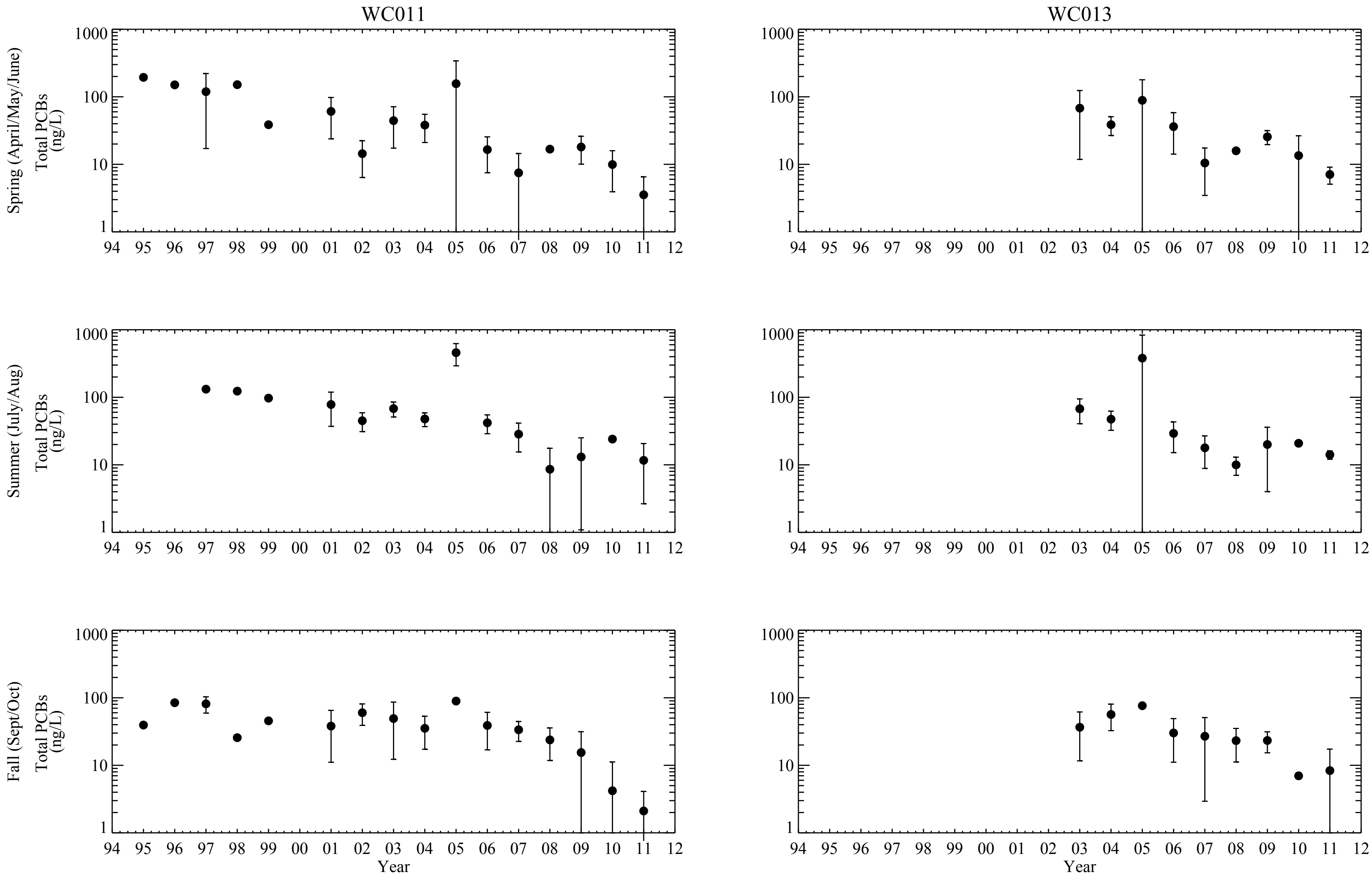


Figure 2-9b. Seasonal Average Water Column PCB Concentrations Measured During Non-Stratified Periods (WC011 and WC013)

Data represent samples collected when river flow was less than or equal to 2200 cfs.
1995 to 1999 data represent composite samples collected during non-stratified periods.
2000 to 2010 data represent surface samples collected at 0.2 times the total water depth to avoid any influence of stratification.
Error bars represent two standard errors of the mean; no error bars shown if sample count is fewer than three.
Duplicates averaged; data collected on same day averaged. Non-detects are plotted at 0.01 ng/L as open circles.
Data tables: riverflow_hist, water_bz, water_peak, water_iupac

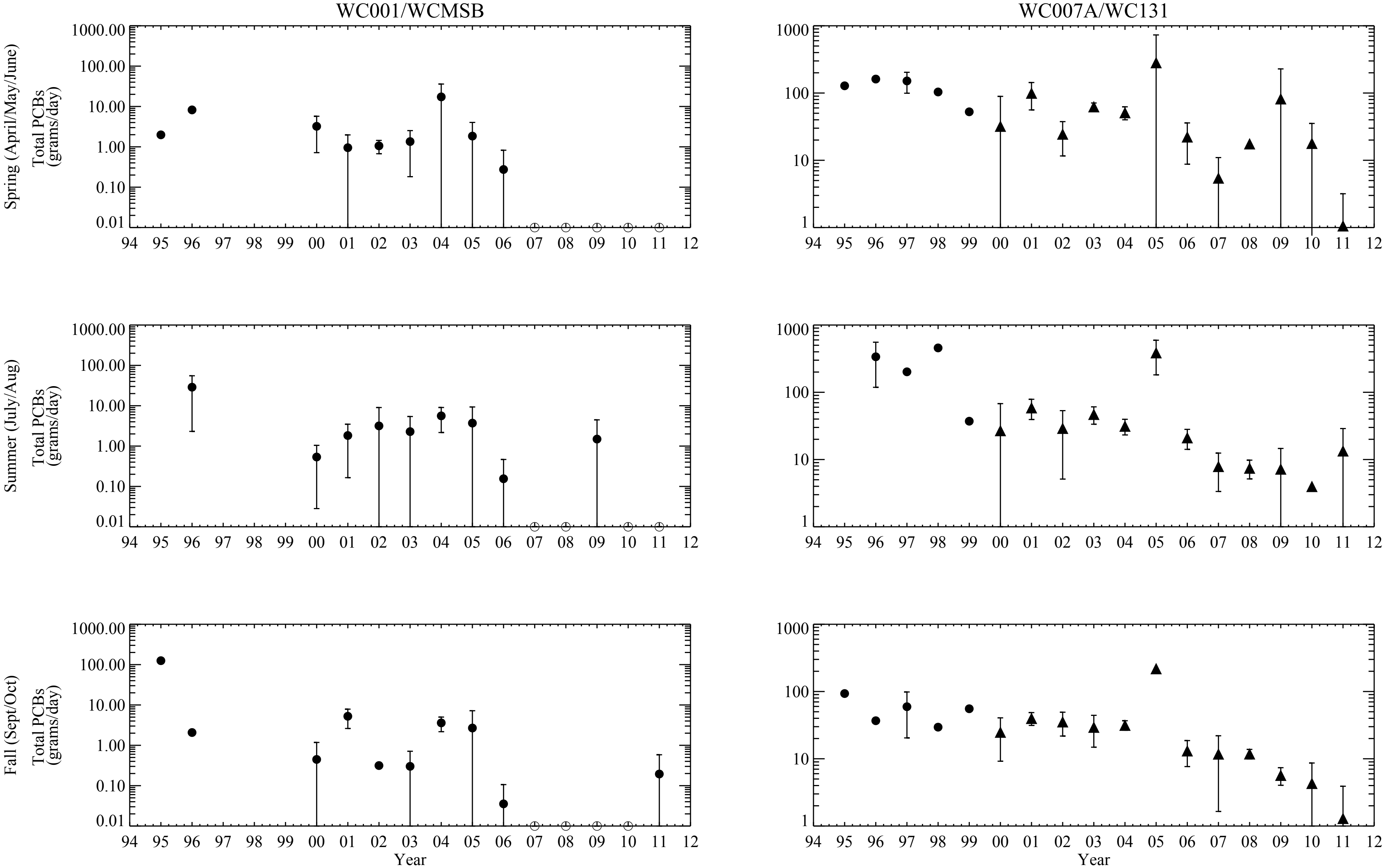


Figure 2-10a. Seasonal Average Water Column PCB Mass Fluxes Measured During Non-Stratified Periods (WC001/WCMSB and WC007A/WC131)

Data represent samples collected when river flow was less than or equal to 2200 cfs. Triangles represent surface samples collected at WC131.
1995 to 1999 data represent composite samples collected during non-stratified periods.
2000 to 2010 data represent surface samples collected at 0.2 times the total water depth to avoid any influence of stratification.
Error bars represent two standard errors of the mean; no error bars shown if sample count is fewer than three.
Duplicates averaged; data collected on same day averaged. Non-detects are plotted at 0.01 grams/day as open circles.
Data tables: riverflow_hist, water_bz, water_peak, water_iupac

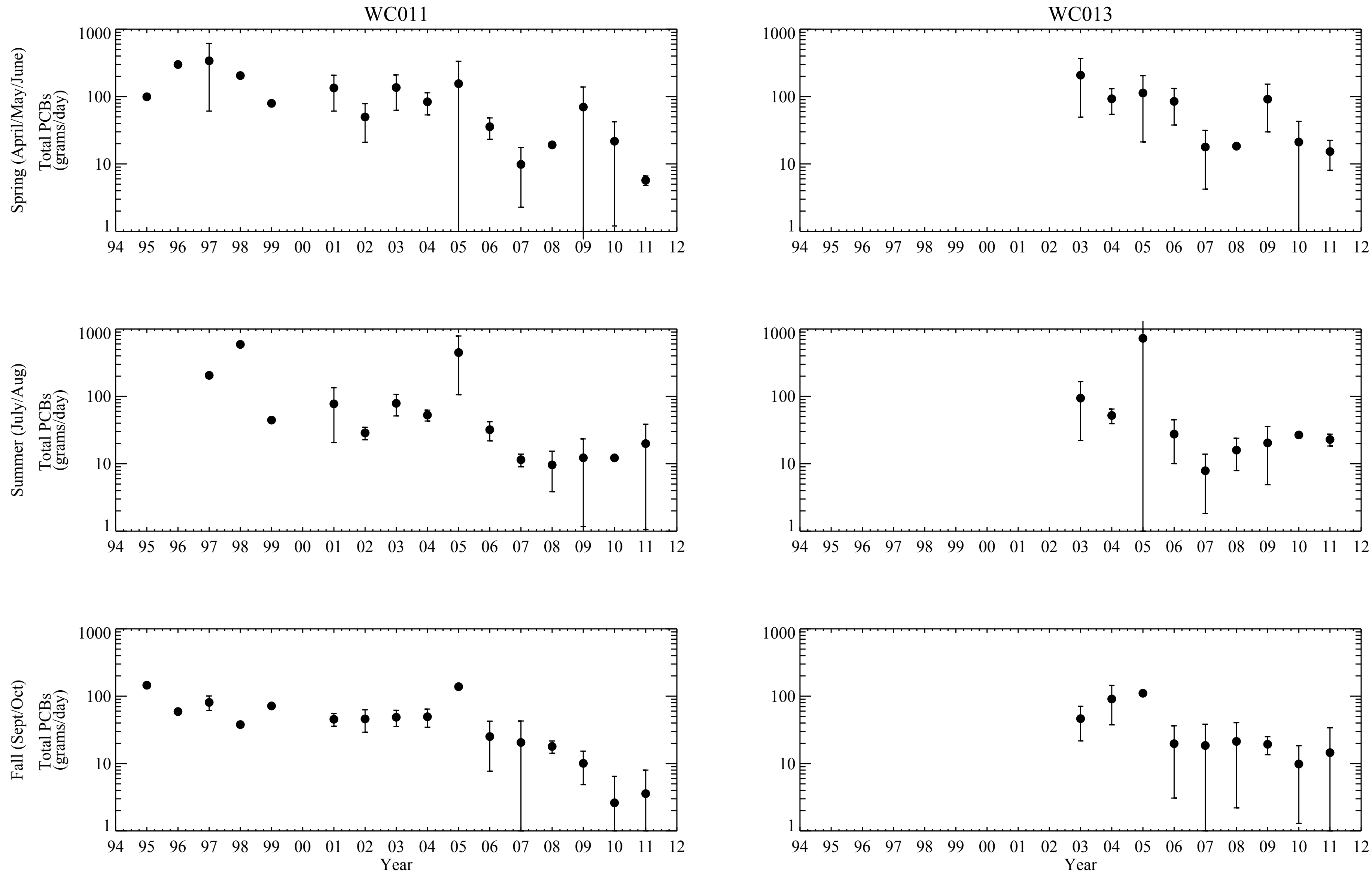
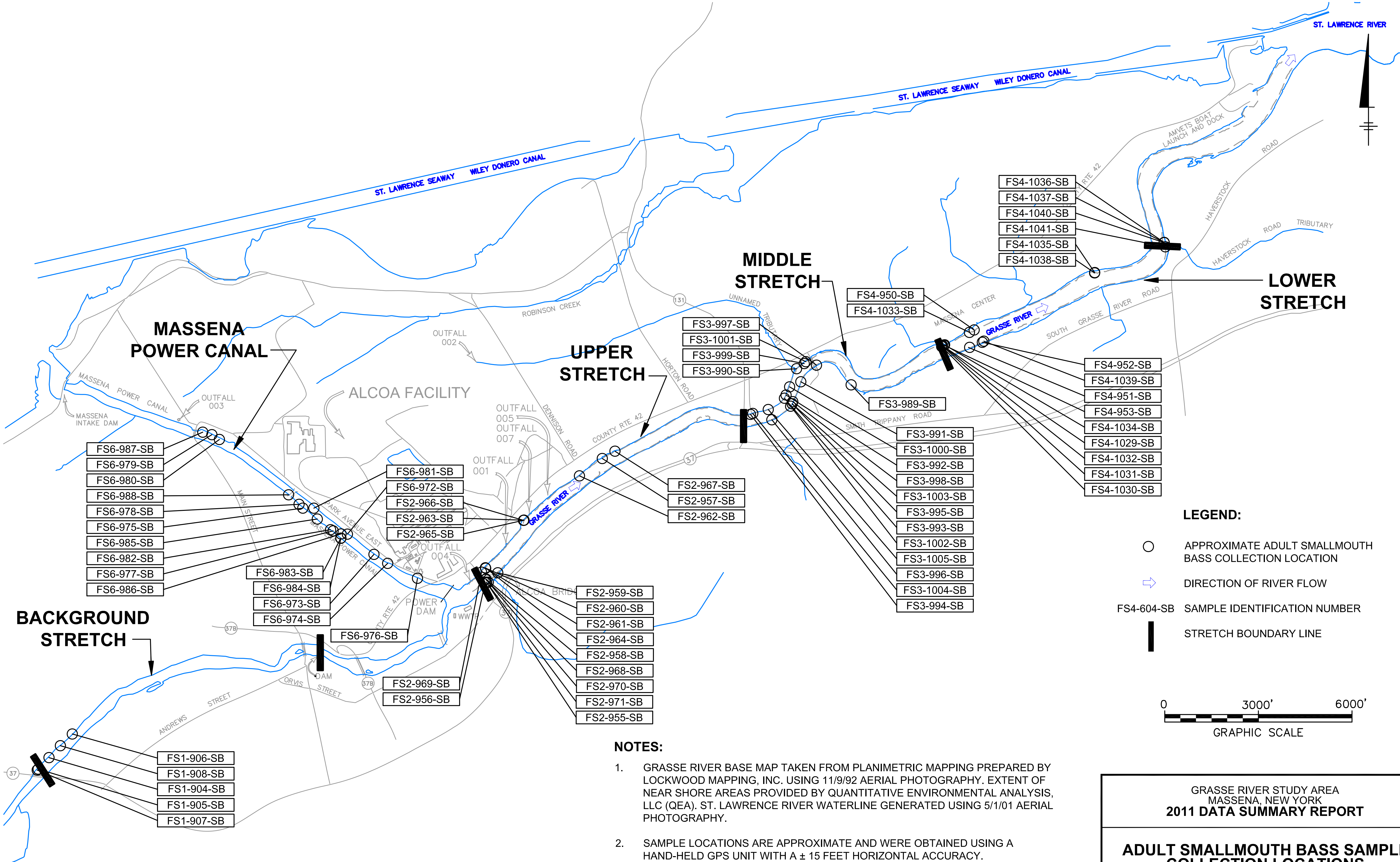


Figure 2-10b. Seasonal Average Water Column PCB Mass Fluxes Measured During Non-Stratified Periods (WC011 and WC013)

Data represent samples collected when river flow was less than or equal to 2200 cfs.
1995 to 1999 data represent composite samples collected during non-stratified periods.
2000 to 2010 data represent surface samples collected at 0.2 times the total water depth to avoid any influence of stratification.
Error bars represent two standard errors of the mean; no error bars shown if sample count is fewer than three.
Duplicates averaged; data collected on same day averaged.
Data tables: riverflow_hist, water_bz, water_peak, water_iupac



LEGEND:

- ○ APPROXIMATE ADULT SMALLMOUTH BASS COLLECTION LOCATION
- ⇨ DIRECTION OF RIVER FLOW
- FS4-604-SB SAMPLE IDENTIFICATION NUMBER
- ▌ STRETCH BOUNDARY LINE

NOTES:

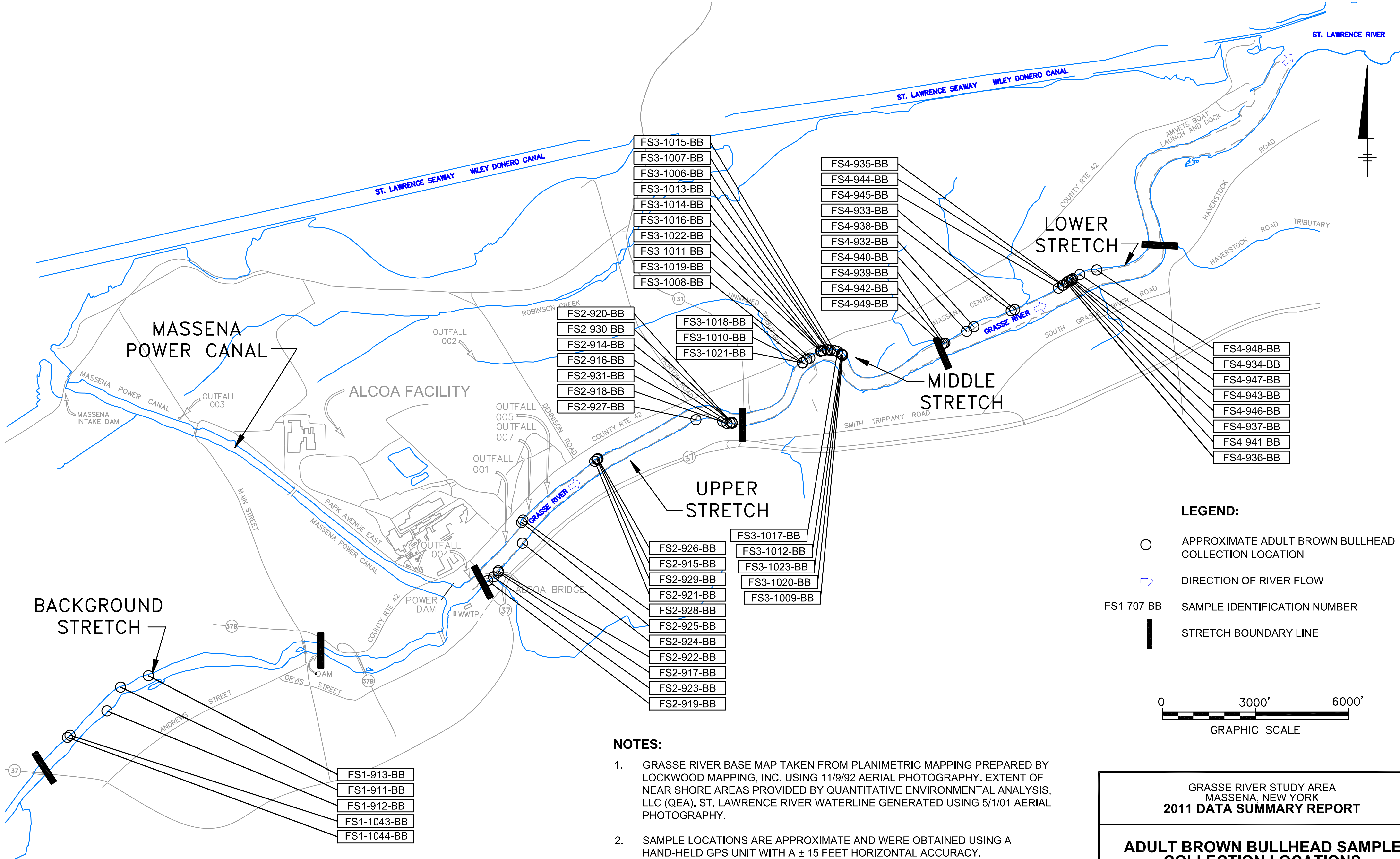
1. GRASSE RIVER BASE MAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA). ST. LAWRENCE RIVER WATERLINE GENERATED USING 5/1/01 AERIAL PHOTOGRAPHY.
2. SAMPLE LOCATIONS ARE APPROXIMATE AND WERE OBTAINED USING A HAND-HELD GPS UNIT WITH A ± 15 FEET HORIZONTAL ACCURACY.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
2011 DATA SUMMARY REPORT

ADULT SMALLMOUTH BASS SAMPLE COLLECTION LOCATIONS

ALCOA

2-11



LEGEND:

- ○ APPROXIMATE ADULT BROWN BULLHEAD COLLECTION LOCATION
- ⇨ DIRECTION OF RIVER FLOW
- FS1-707-BB SAMPLE IDENTIFICATION NUMBER
- ▌ STRETCH BOUNDARY LINE

NOTES:

1. GRASSE RIVER BASE MAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA). ST. LAWRENCE RIVER WATERLINE GENERATED USING 5/1/01 AERIAL PHOTOGRAPHY.

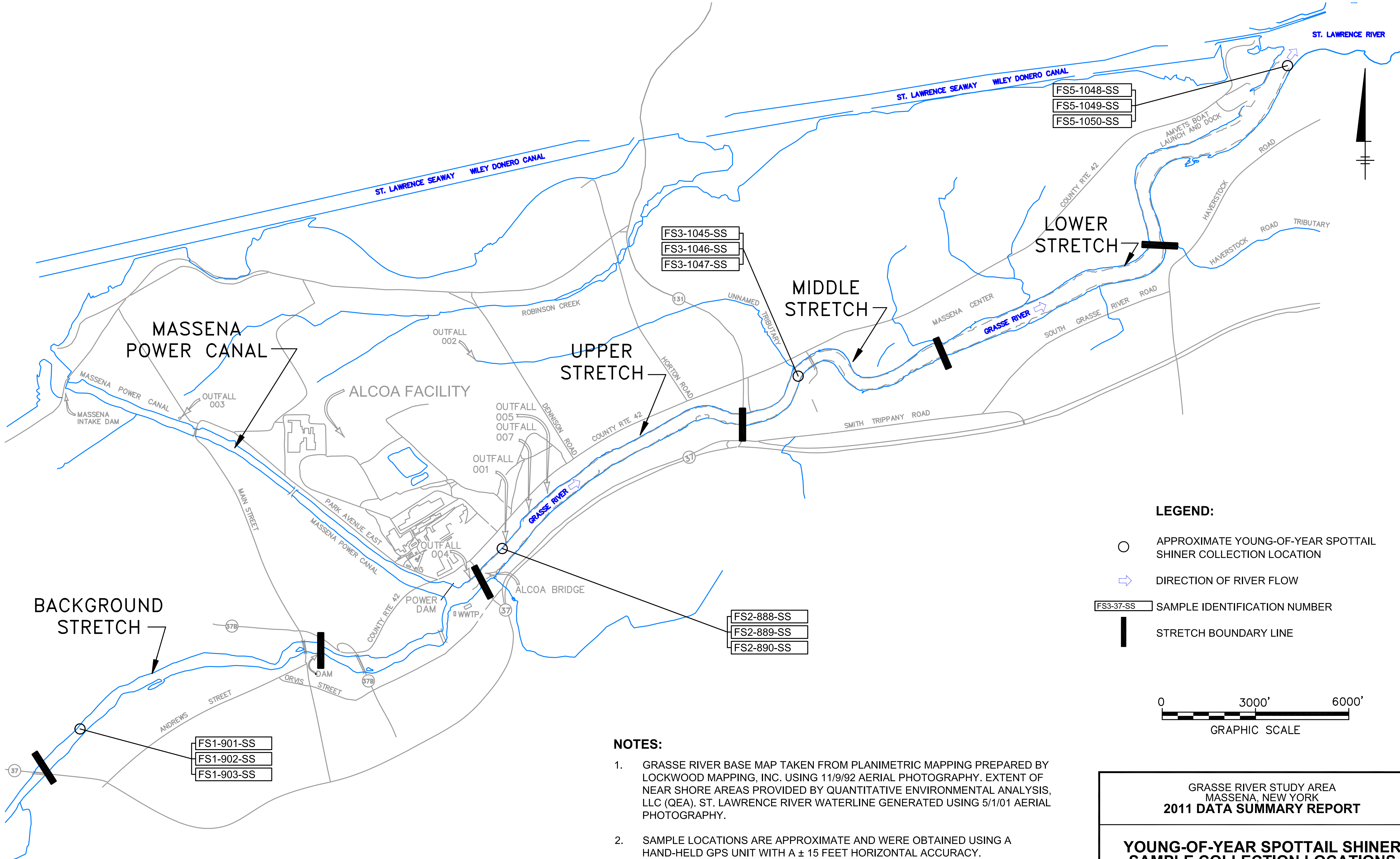
2. SAMPLE LOCATIONS ARE APPROXIMATE AND WERE OBTAINED USING A HAND-HELD GPS UNIT WITH A ± 15 FEET HORIZONTAL ACCURACY.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
2011 DATA SUMMARY REPORT

ADULT BROWN BULLHEAD SAMPLE COLLECTION LOCATIONS

ALCOA

2-12



NOTES:

1. GRASSE RIVER BASE MAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA). ST. LAWRENCE RIVER WATERLINE GENERATED USING 5/1/01 AERIAL PHOTOGRAPHY.

2. SAMPLE LOCATIONS ARE APPROXIMATE AND WERE OBTAINED USING A HAND-HELD GPS UNIT WITH A ± 15 FEET HORIZONTAL ACCURACY.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
2011 DATA SUMMARY REPORT

YOUNG-OF-YEAR SPOTTAIL SHINER SAMPLE COLLECTION LOCATIONS

ALCOA

2-13

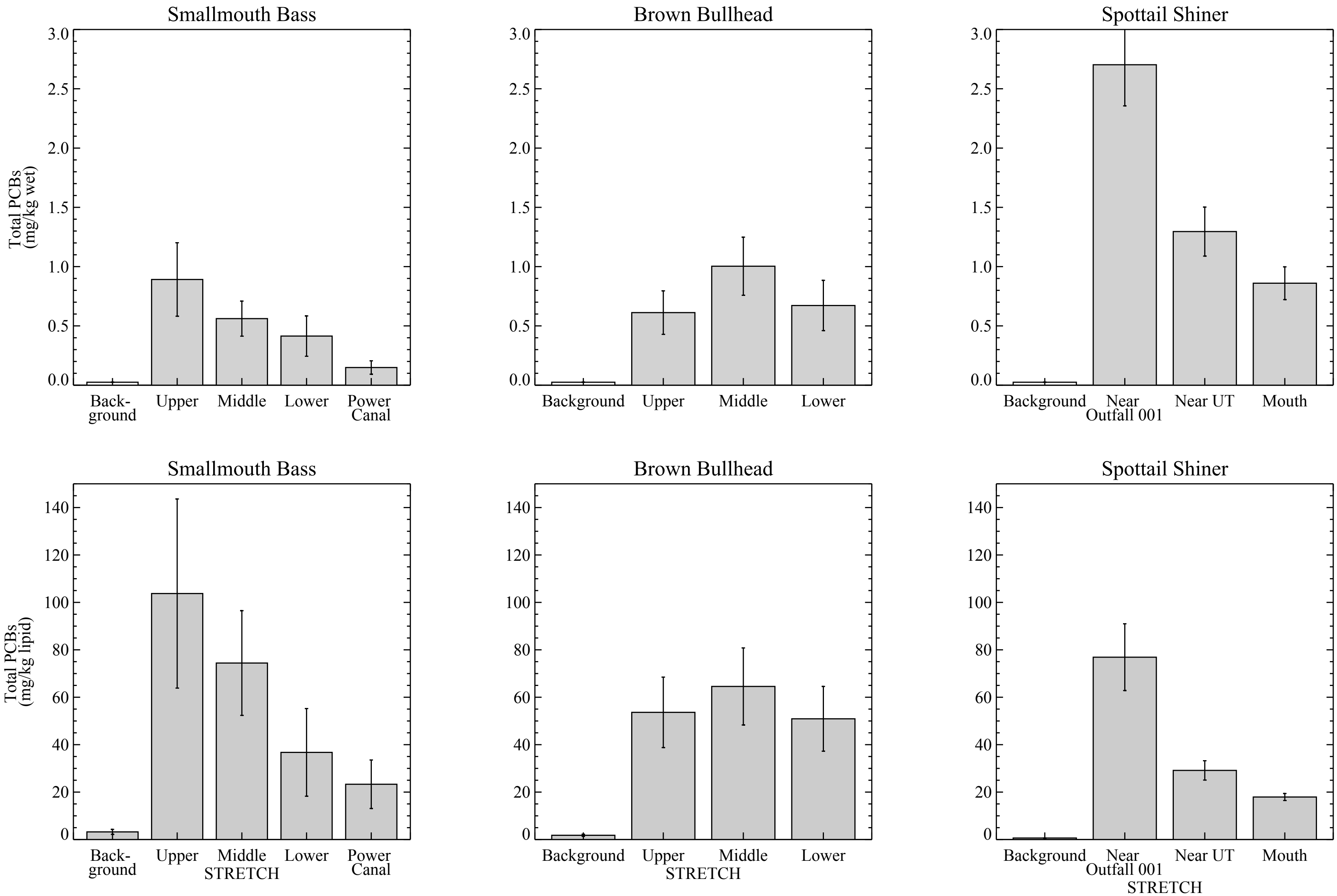


Figure 2-14. Average Aroclor-Based PCB Concentrations in Fish Collected in Fall 2011

Values represent arithmetic averages (+/- 2 standard errors). Non-detect values set to half the detection limit prior to averaging.

Locations where all samples were non-detect are shown as white bars.

Smallmouth bass and brown bullhead - adult individual fillets; spottail shiner - young-of-year whole body composites.

Data table: resfish_aro

ARC - C:\Jobs\ALCgra\Analysis\ResFish\IDL\fall11\resfish_barplot_by_survey.pro
Fri May 11 16:25:15 2012

Smallmouth Bass

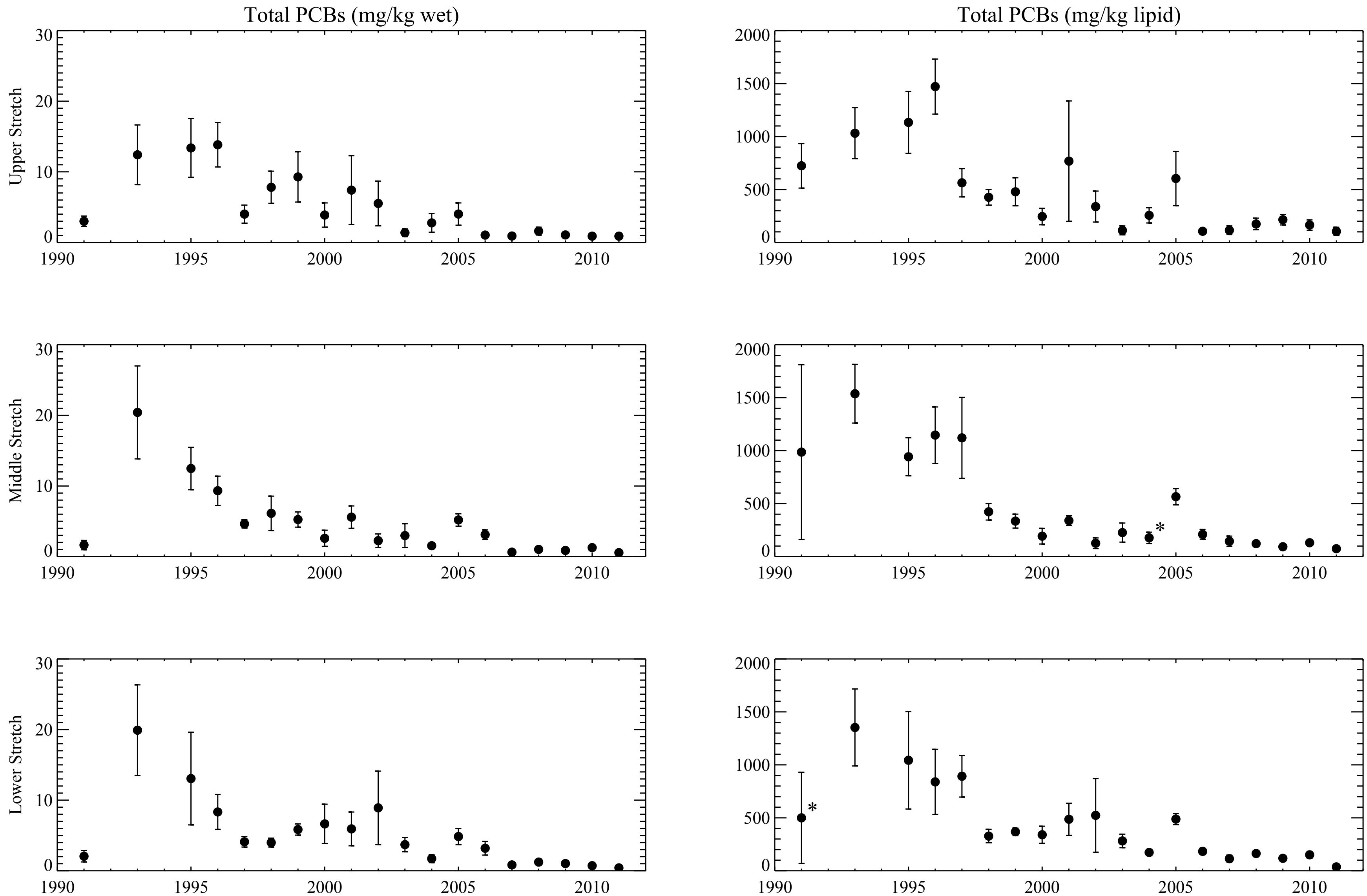


Figure 2-15. Average PCB Levels in Smallmouth Bass (1991 - 2011)
Data are arithmetic means +/- two standards errors of the mean.
Values below detection set to half the detection limit. If no detection limit reported, 0.05 mg/kg wet weight assumed.
Analytical methods employed by the laboratories have changed over time and thus, may affect comparability of these results.
**One 1991 and one 2004 sample were excluded due to unreasonably low lipid content (<0.1%).*

Data tables: resfish_aro

ARC - C:\Jobs\ALCgra\Analysis\ResFish\IDL\fall11\allspec_allloc_PCBwetlip.pro
Fri May 11 16:33:58 2012

Power Canal Smallmouth Bass

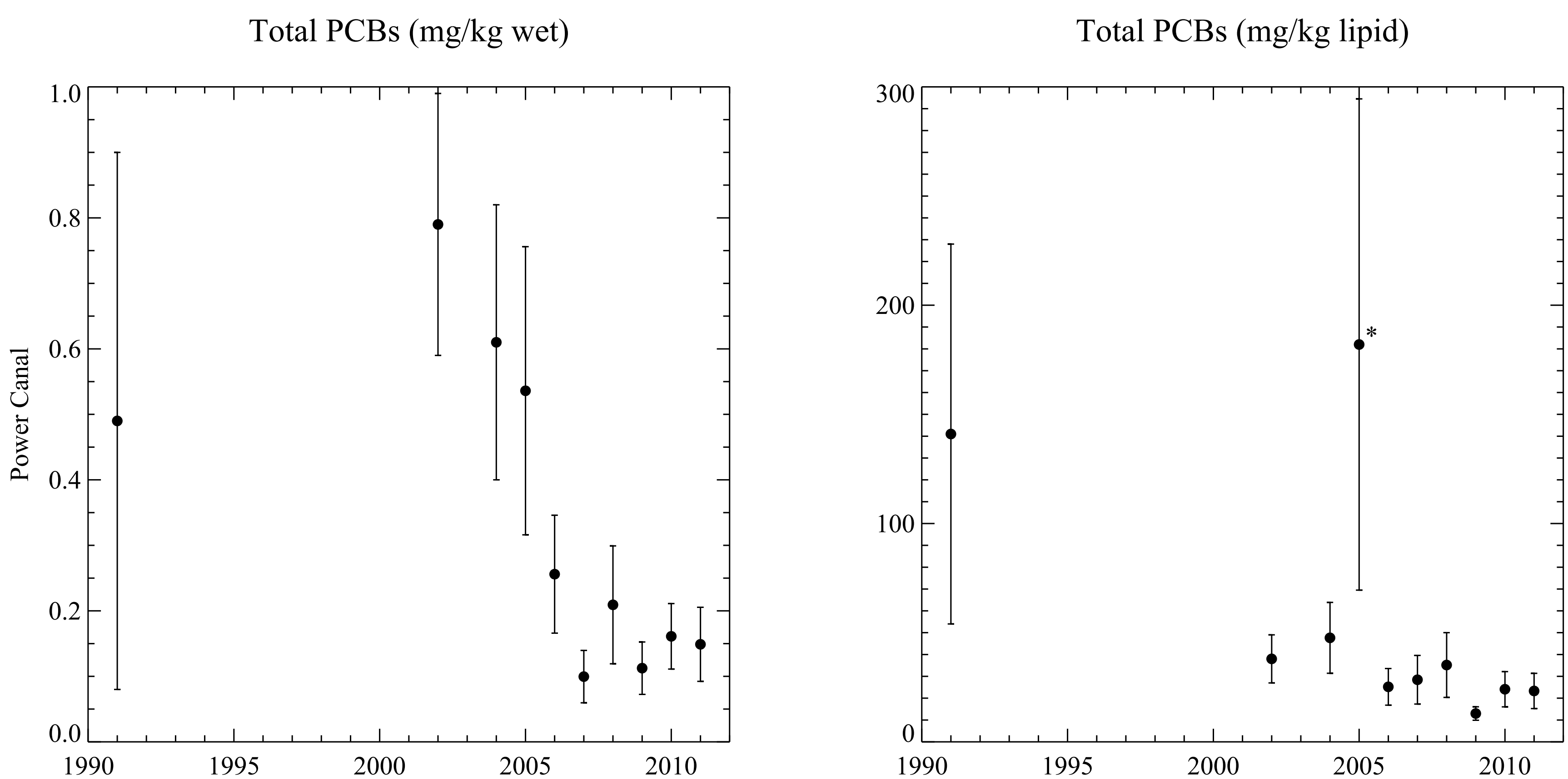


Figure 2-16. Average PCB Levels in Smallmouth Bass from the Power Canal
Data are arithmetic means +/- two standards errors of the mean.
Values below detection set to half the detection limit. If no detection limit reported, 0.05 mg/kg wet weight assumed.
Analytical methods employed by the laboratories have changed over time and thus, may affect comparability of these results.
**One 2005 sample was excluded due to unreasonably low lipid content (<0.1%).*

Data tables: resfish_aro

ARC - C:\Jobs\ALCgra\Analysis\ResFish\IDL\fall11\allspec_allloc_PCBwetlip.pro
Fri May 11 16:33:58 2012

Brown Bullhead

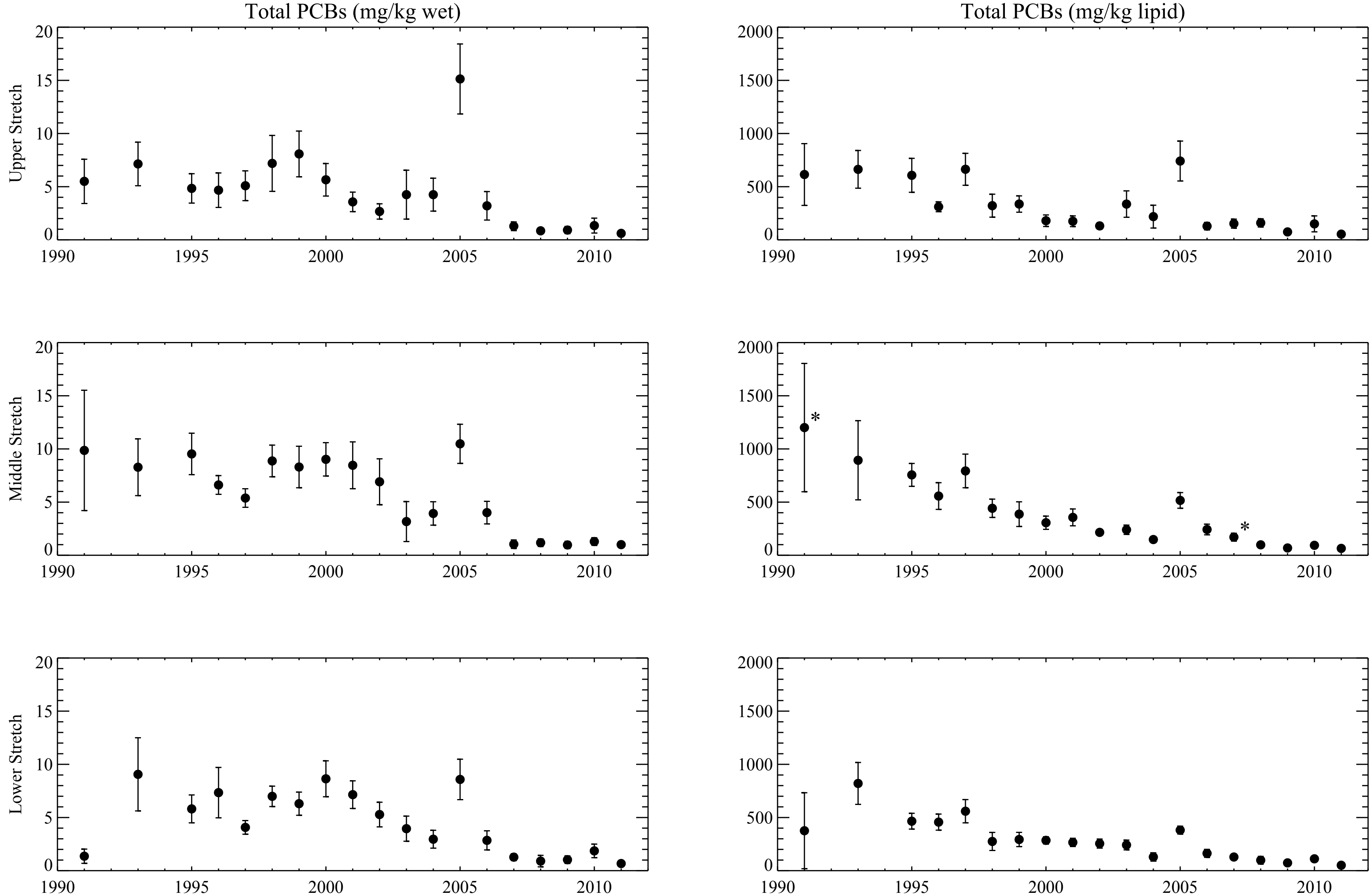


Figure 2-17. Average PCB Levels in Brown Bullhead (1991 - 2011)
Data are arithmetic means +/- two standards errors of the mean.
Values below detection set to half the detection limit. If no detection limit reported, 0.05 mg/kg wet weight assumed.
Analytical methods employed by the laboratories have changed over time and thus, may affect comparability of these results.
**One 1991 and one 2007 sample was excluded due to unreasonably low lipid content (<0.1%).*

Data tables: resfish_aro

ARC - C:\Jobs\ALCgra\Analysis\ResFish\IDL\fall11\allspec_allloc_PCBwetlip.pro
Fri May 11 16:33:58 2012

Young-of-Year Spottail Shiner

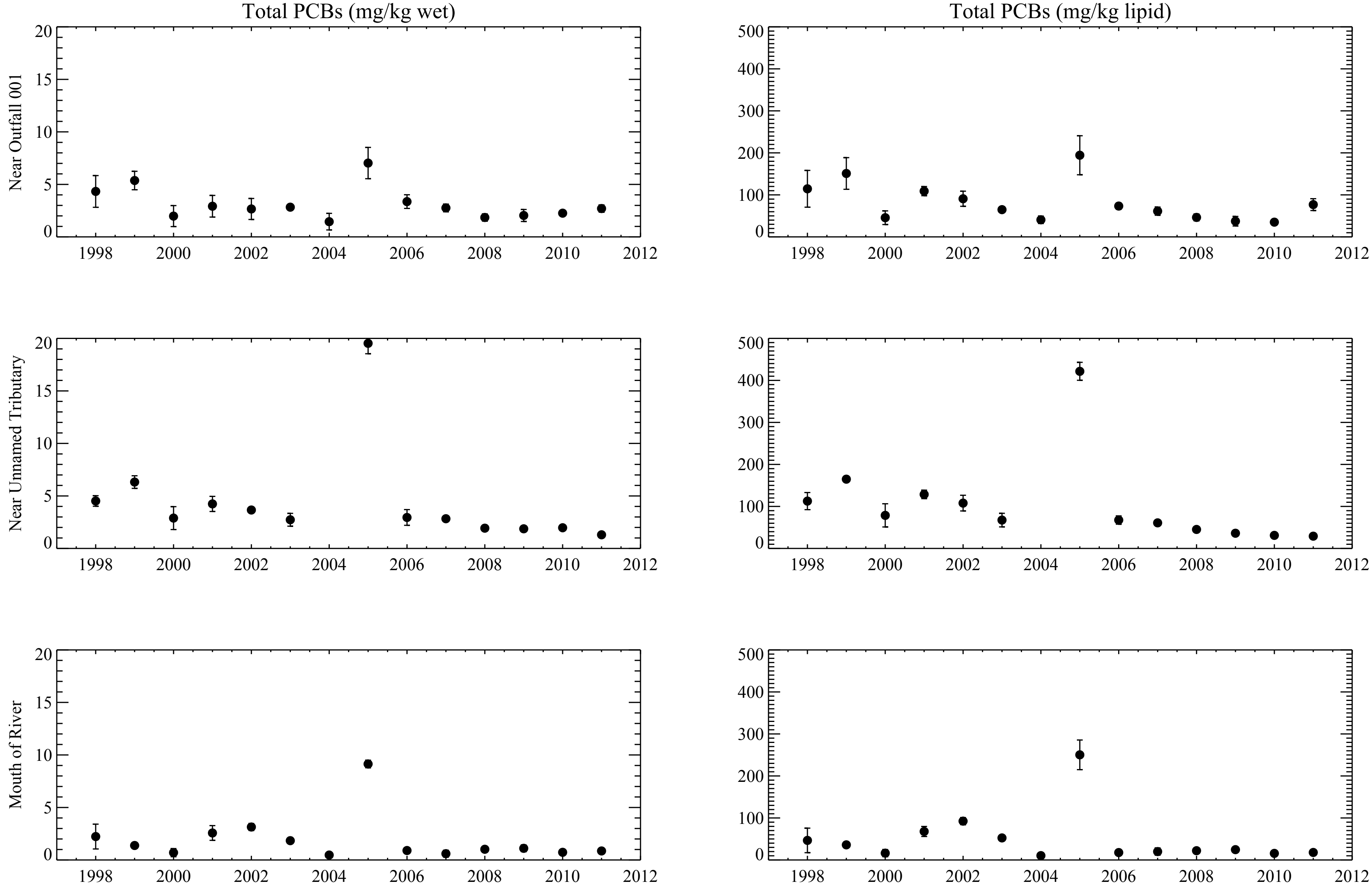
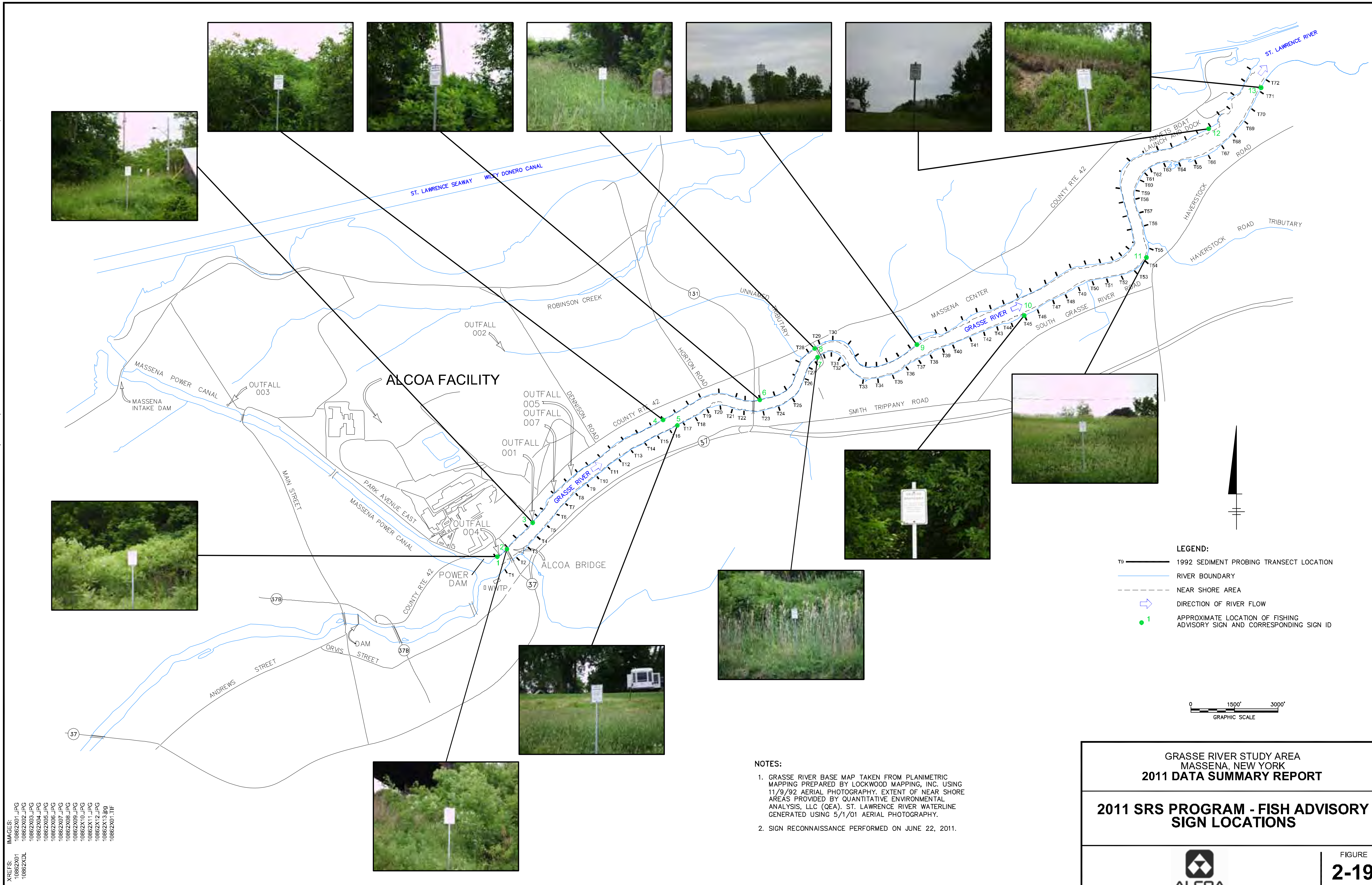


Figure 2-18. Average PCB Levels in Young-of-Year Spottail Shiner (1998 - 2011)
Data are arithmetic means +/- two standards errors of the mean.
Values below detection set to half the detection limit. If no detection limit reported, 0.05 mg/kg wet weight assumed.
Analytical methods employed by the laboratories have changed over time and thus, may affect comparability of these results.
Samples analyzed as whole body composites. Composite was considered as YOY if all lengths were <6.5 cm.

Data tables: resfish_aro

ARC - C:\Jobs\ALCgra\Analysis\ResFish\IDL\fall11\allspec_allloc_PCBwetlip.pro
Fri May 11 16:33:58 2012



NOTES:

1. GRASSE RIVER BASE MAP TAKEN FROM PLANIMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC. USING 11/9/92 AERIAL PHOTOGRAPHY. EXTENT OF NEAR SHORE AREAS PROVIDED BY QUANTITATIVE ENVIRONMENTAL ANALYSIS, LLC (QEA). ST. LAWRENCE RIVER WATERLINE GENERATED USING 5/1/01 AERIAL PHOTOGRAPHY.
2. SIGN RECONNAISSANCE PERFORMED ON JUNE 22, 2011.

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK
2011 DATA SUMMARY REPORT

2011 SRS PROGRAM - FISH ADVISORY SIGN LOCATIONS

ALCOA

FIGURE
2-19

SECTION 3
2011-2011 RIVER ICE MONITORING

Ice monitoring activities were performed on the Grasse River during the 2011/2012 winter season. As with previous years, the 2011/2012 monitoring was conducted in accordance with the modified monitoring program presented and discussed at the USEPA Technical Team meeting on December 18, 2008, and approved by USEPA in an email dated January 19, 2009. For the 2011/2012 winter season, the Grasse River experienced a routine propagation and melt-out with no evidence of ice jams or scouring. No additional work outside the planned monitoring program was required or performed.

This section includes a summary of information gathered throughout the 2011/2012 ice monitoring season, including an analysis of available data regarding the potential for an ice jam event during the natural ice breakup. Ice monitoring locations are presented in **Figure 3-1** and **Table 3-1**. **Figure 3-2** displays a profile of the typical water surface elevations along the 55-mile length of the river.

3.1 CLIMATOLOGICAL CONDITIONS

The climatological data used for this study were measured at Massena International Airport. The daily average temperatures during the winter of 2011/2012 are shown in **Figure 3-3**. A brief description of temperature patterns during the 2011/2012 winter season follows:

- December 2011: after December 15 average air temperatures remained below freezing, resulting in the observation of initial ice cover on the lower Grasse River starting December 27, 2011;
- February 15, 2012 through February 24 2012: several days with average air temperatures above freezing (highest average 38.4 degrees Fahrenheit), but did not result in any major melting or thinning;

- February 25, 2012 through March 6, 2012: average air temperatures remained below freezing, allowing the ice cover to propagate; and
- March 7, 2012 through March 15, 2012: average air temperatures were mostly above freezing, resulting in a gradual melt-out of ice cover in the lower Grasse River.

Figure 3-4 provides a plot of daily total precipitation during the 2011/2012 winter season. Three precipitation events at or above 0.5 in. were recorded during the timeframe after ice formation, one of which occurred in the form of rain just prior to the thermal melt-out period (0.5 in. on March 8, 2012).

3.2 RIVER STAGE MONITORING

3.2.1 River Stage and Flow During Ice Formation

Provisional real-time stage height and flow (discharge) data for the USGS gaging station at Chase Mills, New York (No. 04265432) were downloaded for the period November 1, 2011 to March 22, 2012 from the USGS website [http://waterdata.usgs.gov/nwis/uv/?site_no=04265432]. These data, collected by USGS at 15 minute intervals, are shown in **Figure 3-5a**. Daily average stage height and flow for the same period as reported by USGS are shown in **Figure 3-5b**. Flow was not reported by USGS during periods of ice cover due to potential inaccuracies associated with ice in the vicinity of the gage. As such, no flow readings were available from the Chase Mills gage from December 25, 2011 through March 5, 2012. Additionally, stage height data was not reported between December 28, 2011 and February 19, 2012. All of the USGS data posted on the website and summarized in this report are provisional data subject to USGS review and potential modification.

A sustained ice cover was first observed on the lower Grasse River on December 27, 2011. For the last full day of flow readings prior to freeze up (December 24), the daily average flow was 1,200 and the daily average stage height was 5.19 ft. Stage height continued to be reported beyond December 24 and into a portion of December 28, with daily averages ranging from 5.08 to 5.12 ft.

In May 2008, Alcoa installed a staff gage on the North Channel pier of the Main Street Bridge (Location No. 9 in **Figure 3-1)** in downtown Massena, NY. Alcoa intends to develop and refine a stage-discharge curve or "rating curve" for this gage over time by correlating stage height at the Main Street Bridge gage to discharge at the Chase Mills gage during periods where discharge is not affected by ice (see discussion in **Section 3.2.3**). The gage is used primarily as a secondary source to estimate discharge when the Chase Mills discharge data is not reported. On the freeze up date (i.e., December 27, 2011), the staff gage was obscured by an accumulation of snow/ice on the bridge pier and could not accurately be read. The most recent reading prior to freeze up was on December 22, 2011 with a value of 0.07 ft., which correlates to a flow of 1,167 cfs. For 2011/2012, the Main Street Bridge data is not directly factored into the estimate of discharge at the time of freeze up.

In consideration of the discharge and stage height trends at the Chase Mills gage (**Figure 3-5a** and **3-5b** and supporting tabular data**)**; the discharge at the time of lower river freeze up on December 27, 2011 is estimated at 1,000 cfs.

Additional stage height data were collected from the staff gage at the Alcoa West Plant's Outfall 001 in the lower Grasse River. Outfall 001 is located approximately 1,250 ft. downstream of the Alcoa Bridge (Location No. 7 in **Figure 3-1**). The stage height information is automatically recorded from this bubbler-type level sensor at five-minute intervals and stored by Alcoa for retrieval. On October 21, 2011, a representative from Burgh-Schoenenberger performed the annual inspection of the level sensor and recorder at Outfall 001. No adjustments to the gage were necessary. Daily average stage height readings at the Outfall 001 gage are shown in **Figure 3-6** for November 1, 2011 to March 31, 2012. The average daily stage height at the Outfall 001 gage on the day of observed freeze up (December 27, 2011) was 4.64 ft.

3.2.2 River Stage and Flow During Ice Breakup

To evaluate river stage during the spring ice breakup/melt-out period, the provisional real-time stage height and flow data for the USGS gaging station at Chase Mills were plotted for the period of March 1, 2012 to March 21, 2012 (**Figure 3-7**). Daily average flows and stage heights during the 6-day observed melt-out period in the lower Grasse River (March 9, 2012 through March 15, 2012) are briefly summarized below:

- March 9, 2012: thermal melt-out begins with an average stage height of 5.93 ft. and an average flow rate of 3,492 cfs;
- March 10, 2012: stage height and flow rate peak at an average daily height of 6.42 ft. and flow rate of 5,046 cfs respectively; and
- March 15, 2012: average stage height and flow rate rise to 5.94 ft. and 3,502 cfs, respectively.

Stage height readings at Alcoa's Outfall 001 staff gage are also shown in **Figure 3-7**. The average stage height during the thermal melt-out period was approximately 5.66 ft. As in previous years, daily fluctuations that are associated with the release of water in the St. Lawrence River from power production are observed.

Relative river stage height data from the Main Street Bridge staff gage were collected prior to and during the thermal melt-out period (**Table 3-2**). The measurement taken on March 9, 2012, at the beginning of the thermal melt-out was 1.1 ft. The highest water levels were estimated at 1.1 ft. on March 9, 2012 and March 15, 2012. Based on the most recent rating curve for the Main Street Bridge gage (see **Figure 3-8**), the correlating flows for the stage height measurements are as follows:

- March 9, 2012: 3,227 cfs;
- March 12, 2012: 2,926 cfs;
- March 13, 2012: 2,727 cfs;
- March 14, 2012: 3,027 cfs; and
- March 15, 2012: 3,227 cfs.

3.2.3 Discharge Correlation with Main Street Bridge Staff Gage

Alcoa installed the gage at the Main Street Bridge in May 2008 with the intent of obtaining additional stage and discharge information during the freeze up and breakup periods, when discharge data from the USGS Chase Mills gage may not be available. The discharge during these periods is one of the parameters used to assess the likelihood of a mechanical ice breakup and the potential formation of an ice jam in the lower Grasse River.

Calibration of the gage requires that periodic measurements of stage levels are recorded when correlating discharge data are available at the USGS Chase Mills gage. Because of the height at which the Main Street gage is affixed to the bridge pier, correlating data must be from above-normal river discharge conditions, generally associated with rainfall events. Water levels do not typically reach the base elevation of the Main Street Bridge gage until a discharge of approximately 1,300 cfs or greater is reached. The historical long-term average flow for the Grasse River is 1,100 cfs.

The current rating curve is provided as **Figure 3-8** and includes an inset table of the gage readings collected since December 2008, along with the correlating stage height and discharge from the USGS Chase Mills gage. Although the two gages are approximately 11 miles apart, there are no major tributaries to the Grasse River between Chase Mills and Massena. Based on wave celerity, the approximate lag time of stage change between the gages is believed to be a few hours, but this has not been formally calculated. For purposes of establishing the rating curve, the Main Street Bridge gage height has been plotted versus Chase Mills discharge based on the time of measurement at Main Street (i.e., no lag time). A linear best fit trend line has been drawn using standard functions in Microsoft Excel. Additional data points are needed for correlation above 5,500 cfs.

3.3 ICE THICKNESS MEASUREMENTS AND SIMULATION

The 2011/2012 ice monitoring program included one ice thickness measurement event, performed on February 29, 2012. A computer simulation model was utilized to forecast ice formation and decay during the winter 2011/2012 period. The ice thickness measurements and ice thickness simulations are discussed in the following subsections.

3.3.1 Ice Thickness Measurements

Ice thickness measurements were collected at the Route 131 Bridge, Outfall 001, and Route 37 Bridge locations on February 29, 2012 (see **Figure 3-1**). A snow and/or slush cover was observed at all three locations. A motorized auger was used to bore 8-in. diameter holes through the ice. These locations were 25 ft. off the north shore, midway to the center of the channel, and at the center of the channel. A tape measure probe was used to hook onto the bottom of the ice cover and measure upward to the top of the borehole. The total depth of material was visually differentiated between solid ice and porous snow cover or slush. The ice thickness measurements and calculated averages are summarized in **Table 3-3**. The overall average ice thickness considering all six boreholes measured in the lower Grasse River was 11.2 in.

3.3.2 Ice Thickness Simulations

During the winter of 2011/2012, the growth and decay of the ice cover thickness were simulated using a model developed by Clarkson University. The model uses measured and forecasted air temperature data from Massena International Airport. Thickness simulations were started on December 28, 2011, and continued through March 20, 2012. A 15-day air temperature forecast was periodically uploaded into the model to generate a graph showing predicted ice cover thickness over time. As the winter progressed, the "predicted thickness" portion of the curve was replaced by a "simulated thickness," based on the measured air temperatures.

Figure 3-9 graphs the simulated ice thickness over the winter based on actual daily average air temperatures. For comparison, the measured maximum and minimum thickness values and calculated average of the lower Grasse River for the ice thickness measurement event on February 29, 2012 are also shown in **Figure 3-9**. **Figure 3-10** provides the results of the ice thickness simulation from February 23, 2012 through the decay phase ending March 15, 2012.

After the initial formation of an intact ice cover on December 27, 2011, the maximum simulated thickness of 17.9 in. was reached on March 6, 2012. For comparison, the maximum simulated thicknesses for 2005 through 2011 ranged from 20 to 27 in., with an average of 22.9 in. On February 29, 2012, the average thickness measured in the lower Grasse River was 11.2 in. and the simulated ice thickness was 17.2 in. (a difference of 6.0 in.). The simulation indicates the ice thickness remained near its maximum for only a short period of time. Two days after the maximum thickness was reached a rapid decay started. With the exception of a period of 3 days when the thickness remained constant at 9.5 in., the decay continued until March 15, 2012 when the ice thickness reached 0 in. The simulation results were consistent with the visual observations with respect to final ice melt-out.

3.4 MONITORING OF RIVER ICE BREAKUP

Starting March 7, 2012, the average daily temperatures were generally above freezing, which resulted in the gradual melt-out observed in the lower Grasse River. For purposes of discussion in this section, the breakup or melt-out period has been designated as March 9, 2012 through March 15, 2012. Select photographs during the ice breakup period are presented in **Figure 3-11,** and the comprehensive photographic record for the winter is provided in **Appendix B**. The USGS began reporting discharge at the Chase Mills gage on March 6, 2012, which is an indication that ice had moved out from that portion of the upper river. Based on prior years monitoring activities, the Grasse River ice cover typically breaks up from upstream to downstream (south to north). Baseline observations were made on March 9, 2012 due to observed higher temperatures as well as simulated ice thickness model results. Observations by the field crews are summarized below for the March 9 through March 15, 2012 timeframe during which the thermal melt-out occurred. Location references correlating to **Figure 3-1** are included in the observation summary.

> *March 9, 2012: 10:30 a.m. through 11:30 a.m.* – Intact ice cover with evidence of shore melt was observed both upstream and downstream of the NYS RT 37 Bridge (Location 10). In the vicinity of the Alcoa Bridge (Location 7) an open channel was observed which extended from the old power dam to just upstream of Outfall 001 (Location 6). In

addition, a narrow open channel was observed in the center of the river from the bridge to a few hundred feet downstream. There was little to no evidence of ice cover deterioration in the vicinity of the Capping Pilot Study Area (CPSA, Location 5) with the exception of one hole near the upstream limit of the CPSA. The ice cover, both upstream and downstream of the NYS Route 131 Bridge (Location 4), showed signs of pitting along the north side of the river. No evidence of deterioration was observed in the vicinity of Haverstock Road (Location 2). Snow cover was mostly gone from all locations.

March 12, 2012: 3:00 p.m. through 4:00 p.m. – In the vicinity of the NYS Route 37 Bridge there was more advanced shore melt along the north shoreline and holes were beginning to form in the ice cover. In the vicinity of the Alcoa Bridge the channel along the north shore now extended to near the center of the river. There was a minor collection of ice floes in this channel upstream of Outfall 001. The center of the river at the CPSA had begun to develop holes through the ice cover. Significant pitting and holes were observed along the north shore upstream of the NYS Route 131 Bridge. No evidence of deterioration was observed in the vicinity of Haverstock Road.

March 14, 2012: 12:30 PM through 1:30PM – The ice cover both upstream and downstream of the NYS Route 37 Bridge was extremely deteriorated. It appeared to be very thin with large areas of open water. Upstream of the Alcoa Bridge was free of ice. Downstream of the Alcoa Bridge minor ice floes had collected. The ice cover appeared to be very thin with a wide open channel along the north shore. The CPSA was nearly clear of ice with the exception of some shorefast ice along the south shoreline.

March 15, 2012: 2:00 PM through 3:00PM – The entire lower river was observed as clear of ice with exception of shorefast ice at Haverstock Road.

The breakup conditions, as described above and viewed through photographs, indicated that a thermal melt-out occurred without any significant potential for an ice jam that would produce a bed scouring event.

3.5 SUMMARY AND CONCLUSIONS

Mechanical ice breakup in the upper Grasse River can lead to ice jams in the lower Grasse River if an intact ice cover of sufficient strength exists in the lower Grasse River that would prevent the continued movement of ice floes entering from upstream. As discussed in the hindcasting analysis provided in Appendix N of the *Draft Addendum to the Comprehensive Characterization of the Lower Grasse River* (Alcoa, April 2009), mechanical ice breakup and ice jams may occur in the lower Grasse River when the discharge increase from freeze up to breakup exceeds approximately 3,500 cfs and the ice at the time of breakup is thicker than approximately 15 in. Reaching these conditions does not necessarily mean that ice jams sufficient to disturb sediments would form, but these conditions are considered to be the threshold of concern in relation to an ice jam event that can result in a significant disturbance of the bottom sediments, as was observed during the 2003 ice jam event. Analysis of river flow and ice thickness data (simulated and/or measured) can determine whether these threshold conditions were met. In conjunction with the results of visual observations, these data can help assess the likelihood of whether a significant ice jam has occurred. The ice monitoring results for 2011/2012, and assessment of the breakup conditions with respect to ice jams, is provided below.

Visual observations were made from various locations along the Grasse River during the 2011/2012 winter season, and a photographic record was developed (**Appendix B**). The lower Grasse River below the Alcoa Bridge (Location No. 7 in **Figure 3-1**) was fully covered with ice by December 27, 2011, and consistent ice cover remained through mid-March 2012. River flow at the time of freeze up was estimated at 1,000 cfs.

The growth and decay of the ice cover was numerically simulated during the 2011/2012 winter season. The predicted maximum thickness of 17.9 in. occurred on March 6, 2012, with a complete melt-out predicted by March 15, 2012 (**Figure 3-10**). At the start of the observed thermal melt-out period on March 9, 2012, thickness was simulated as 13.5 in., but was predicted to rapidly decline thereafter. Ice thickness measurements collected on February 29, 2012 provided an average ice cover thickness of 11.2 inches in the lower Grasse River. The measured thickness was approximately 6.0 inches lower than predicted by the computer model.

The Grasse River experienced a gradual melt-out beginning on March 9, 2012. Based on the field observations, the breakup or melt-out period was designated as March 9, 2012 to March 15, 2012. No significant precipitation events occurred during this timeframe (**Figure 3-4**). In general, ice cover observed in the lower Grasse River was highly deteriorated and had formed several stretches of open water by March 12, 2012. The USGS reported daily average flow rates between 2,938 and 5,046 cfs during the breakup period (**Figure 3-5b**). Using the highest of these values (5,046 cfs on March 10); the flow differential above the estimated freeze up discharge (1,000 cfs) is 4,046 cfs, which exceeds the threshold condition of 3,500 cfs. Ice thickness in the lower Grasse River during the time of maximum flow (March 9 to 10), however, would have been significantly less than 15 in., given the 11.2 in. average measured thickness on February 29, 2012 and the deterioration that was observed. Based on the measured and simulated ice thickness and the river flow differential between freeze up and breakup, the threshold conditions for a mechanical ice breakup and potentially significant jam (a flow differential of 3,500 cfs and an ice cover in excess of 15 inches at breakup) were not met.

Field crews did not observe movement of ice floes from the upper Grasse River into the lower Grasse River during the thermal melt-out period. The gage at Outfall 001 showed a gradual increase then decrease in stage height during the March 9, 2012 to March 15, 2012 timeframe (**Figure 3-7**), but no sharp spikes in river stage that would indicate an ice jam. Based on the visual observations and supporting data on stage height, river flow, air temperature, precipitation and ice thickness measurements, the March 2012 breakup can be characterized as a thermal melt-out that did not create ice jam conditions for the lower Grasse River.

Table 3-1.
Ice Monitoring Locations

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Location Number	Ice Monitoring Location[1]	Road Designation	Approximate 1992 Sediment Probing Transect Number[2]
1	AmVets Property	---	66
2	Haverstock Road	---	54
3	Massena Center	---	28
4	Route 131 Bridge	Route 131	22
5	Capping Pilot Study Area	---	16
6	Outfall 001	---	5
7	Alcoa Bridge	Alcoa Road	2
8	Parker Street Bridge	Route 37B	---
9	Main Street Bridge	Route 420	---
10	Route 37 Bridge	Route 37	---
11	Massena Rod and Gun Club	---	---
12	Louisville Bridge	Route 39	---
13	Chase Mills Bridge, USGS Gage	Route 36	---
14	Chamberlain Corners Bridge	Route 44	---
15	Madrid Bridge	Route 345	---

Notes:

1. Shaded locations were designated for use in 2011/2012 monitoring program; refer to **Figure 3-1**.

2. Refer to **Figure 2-1** for transect locations.

Table 3-2.
Stage Height Measurements from Main Street Bridge Staff Gage
Winter 2011/2012

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Date	Time	Gage Height (ft) [1,2]
12/22/2011	2:53 PM	0.07
3/9/2012	11:05 AM	1.1
3/12/2012	3:52 PM	0.9
1/4/1900	12:46 PM	0.85
3/14/2012	12:58 PM	1
3/15/2012	2:37 PM	1.1

Notes:

1. All measurements taken from the staff gage installed in the North Channel of the Grasse River at Main Street Bridge in Massena, NY.
2. Base elevation (0.0) for the gage is 176.25 ft NAVD 1988.

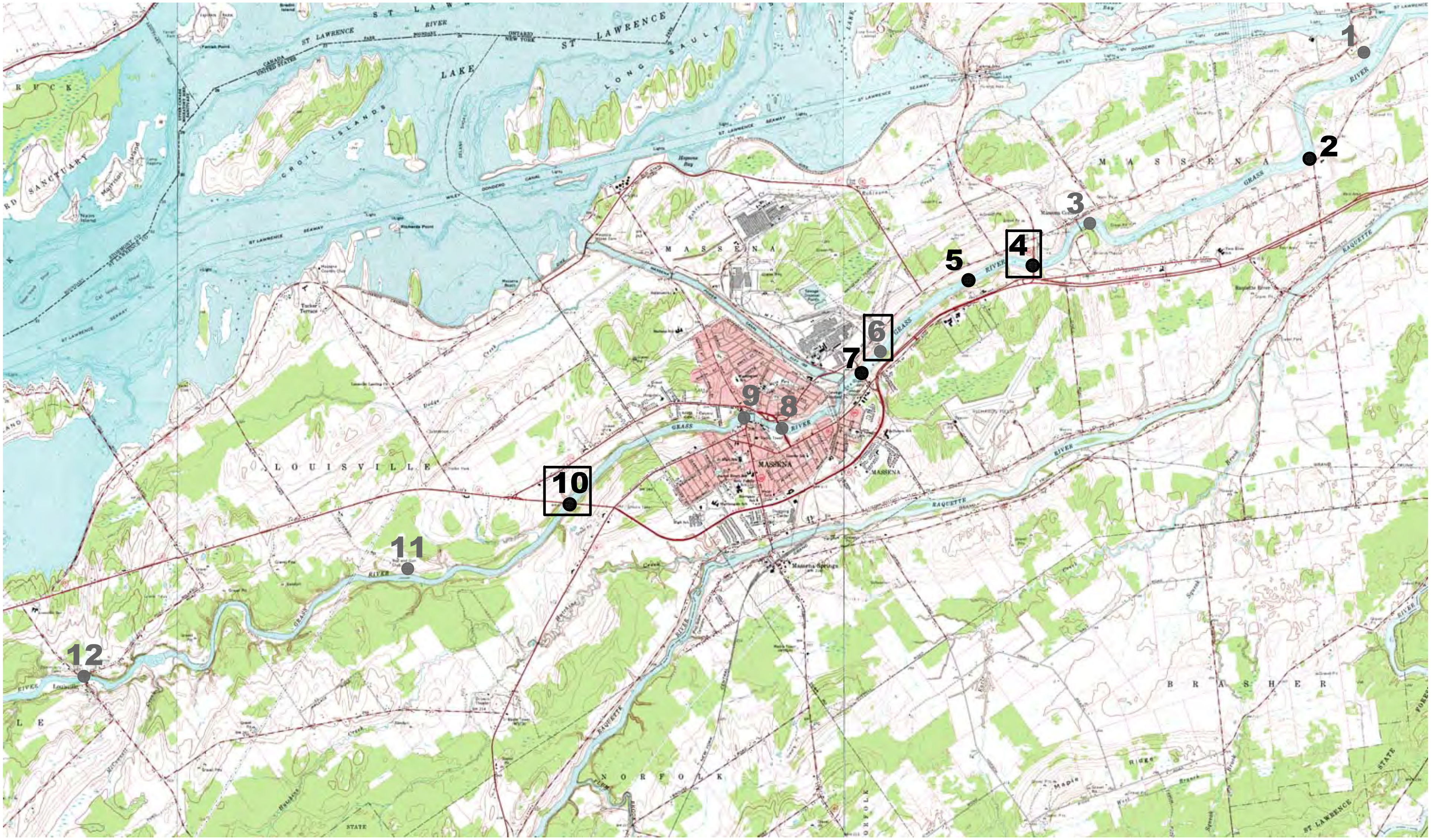
Table 3-3.
Ice Thickness Measurements

2011 Data Summary Report
Grasse River Study Area, Massena, New York

Borehole [1]	Distance from North Shore (ft)	Snow/Slush Depth (in)	Total Ice (in)	White Ice (in)	Black Ice (in)
Upper Grasse River Location 10 (Route 37 Bridge)					
1	25	6	10	5	5
2	50	6	12	7	5
4	75	5	11.5	3	8.5
Average			11.2		
Lower Grasse River Location 4 (Route 131 Bridge)					
1	25	5	14	5	9
2	50	4	7	5	2
3	75	3	10	5	5
Average			10.3		
Lower Grasse River Location 6 (Outfall 001)					
1	25	6	11	4	7
2	50	6	12	6	6
3	90	6	13	5	8
Average			12.0		
Lower River Average			**11.2**		

Note:

1. All ice thickness measurements were collected on February 29, 2012.



KEY:

8 ● FORMER ICE MONITORING LOCATION

7 ● CURRENT ICE MONITORING LOCATION

4 ● ICE THICKNESS LOCATION

GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

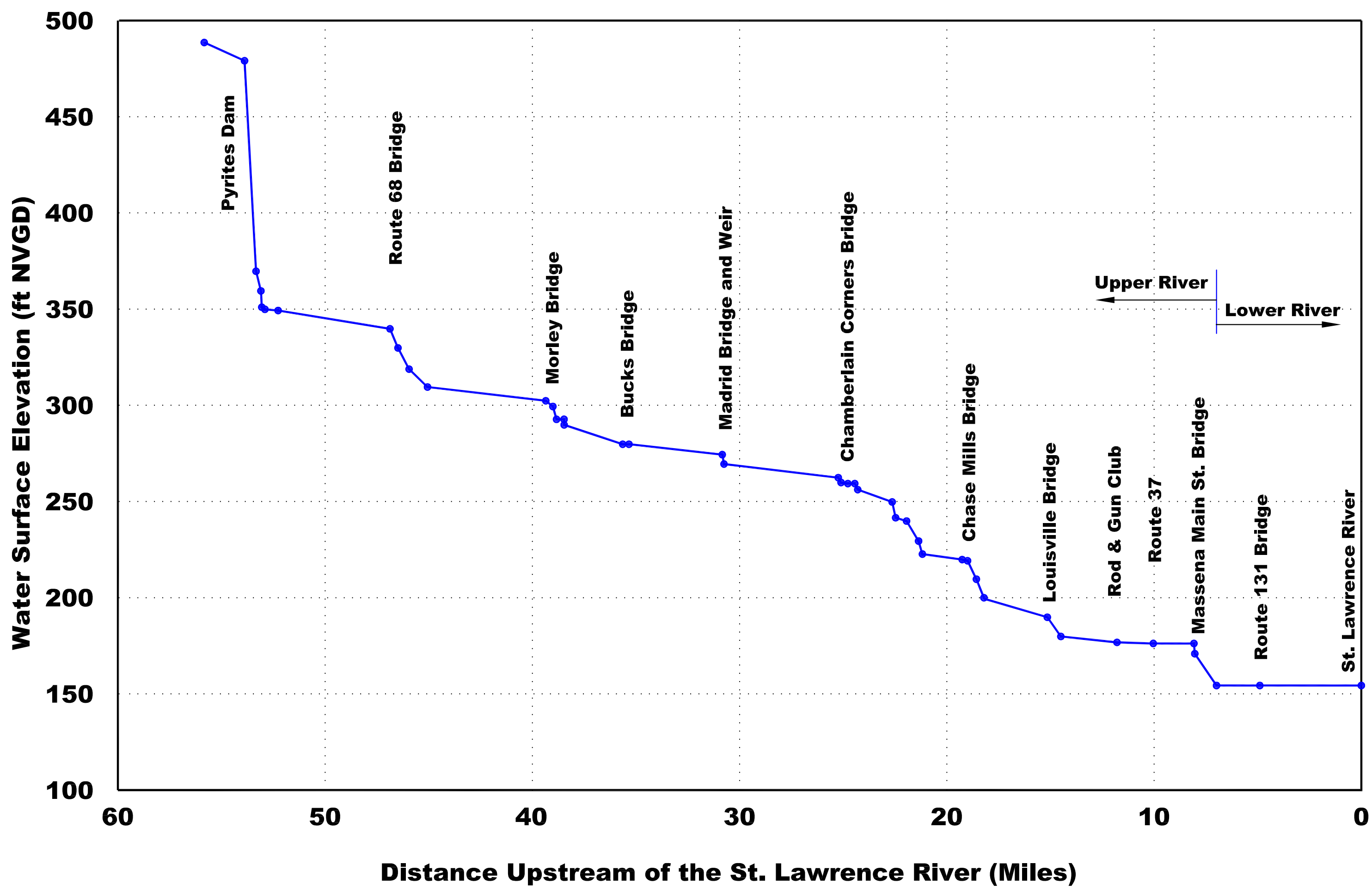
2011/2012 GRASSE RIVER ICE MONITORING LOCATIONS

ALCOA

FIGURE

3-1

L:\ALCOA\Massena West\Grasse River\ICE MONITORING–GRASSE\DWG\ ice monitoring–2009–2010 03/01/11 06:59 topotj



GRASSE RIVER STUDY AREA
MASSENA, NEW YORK

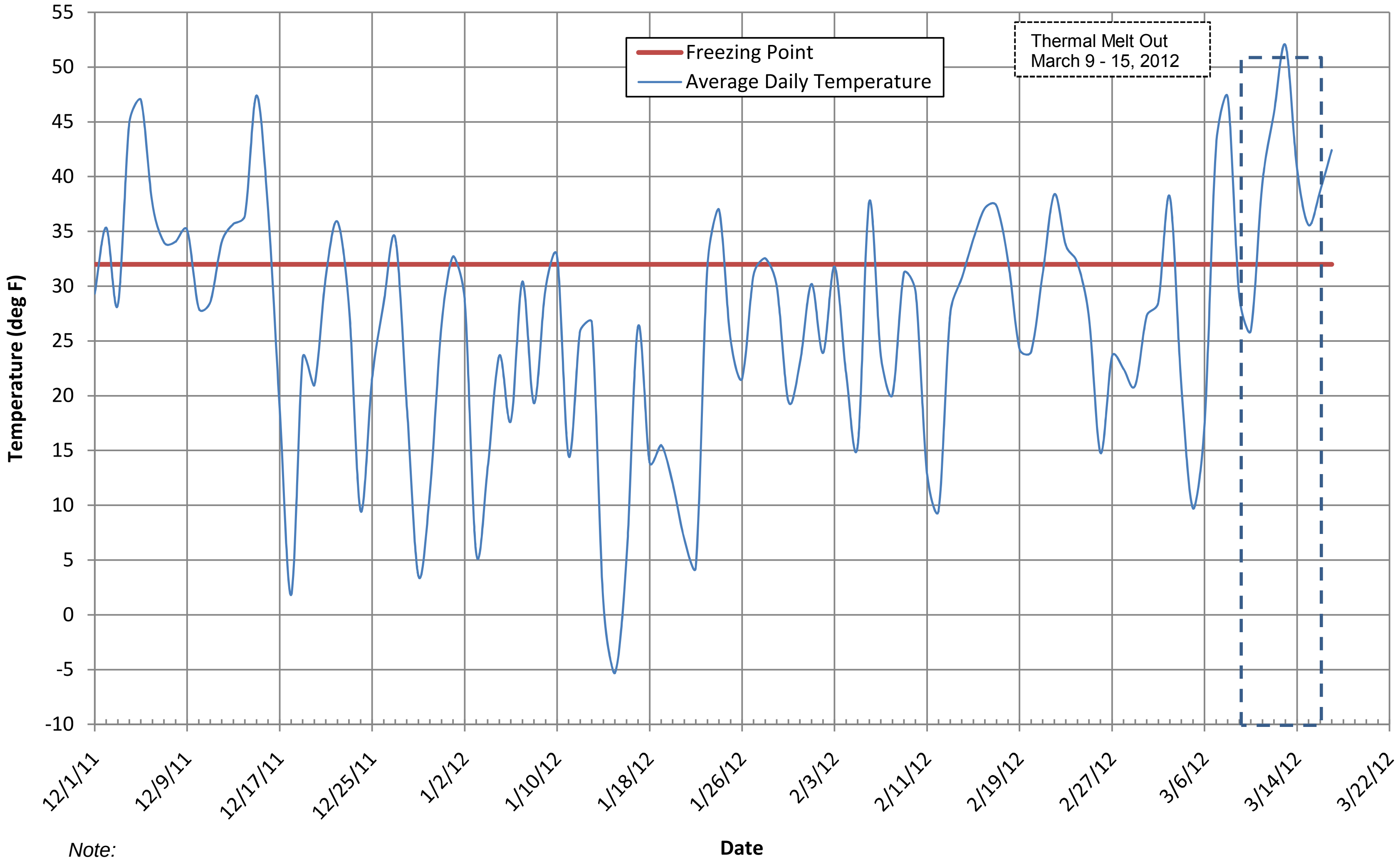
TYPICAL WATER SURFACE ELEVATION OF THE GRASSE RIVER

ALCOA

FIGURE **3-2**

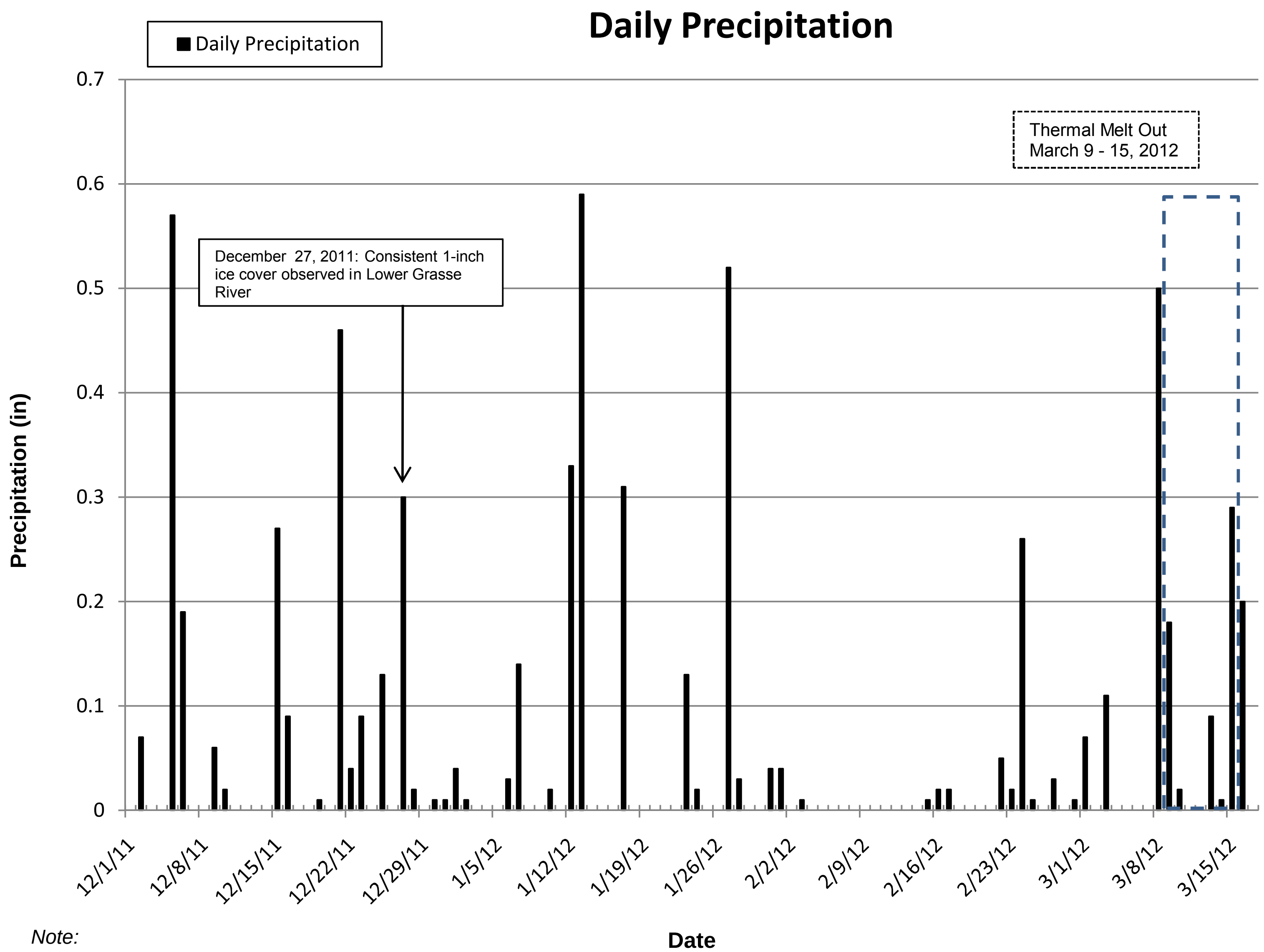
Note:

1. Water surface elevations obtained from USGS 7.5 minute series topographic quadrangles.



Note:
-Temperature data reported from Massena International Airport

Figure 3-3
Air Temperature for Winter 2011/2012
Massena, NY



Note:
-Precipitation data reported from Massena International Airport

Figure 3-4
Precipitation Data for Winter 2011/2012
Massena, NY

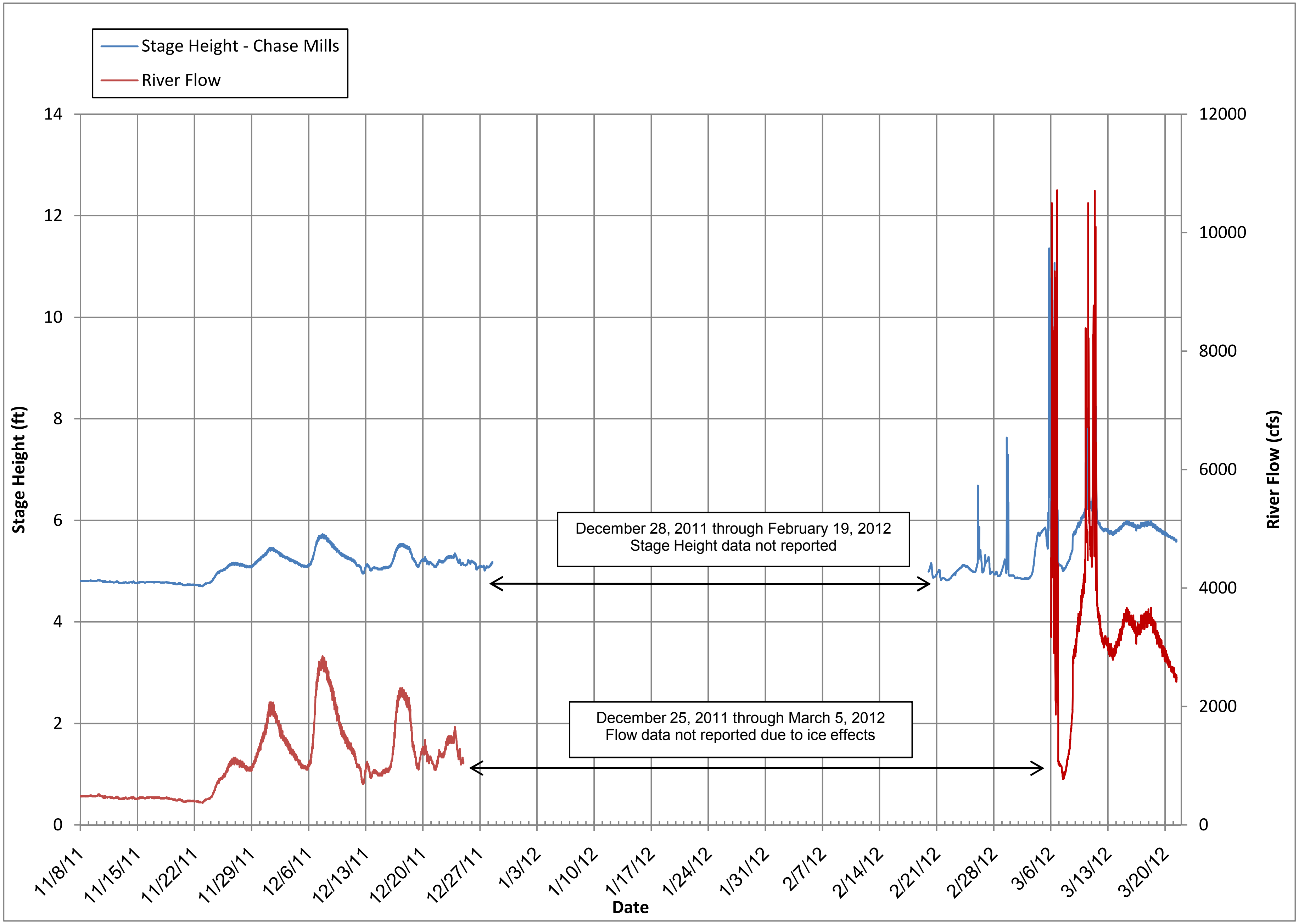


Figure 3-5a
Real Time Stage Height and Flow for Winter 2011/2012
Chase Mills, NY USGS Gaging Station

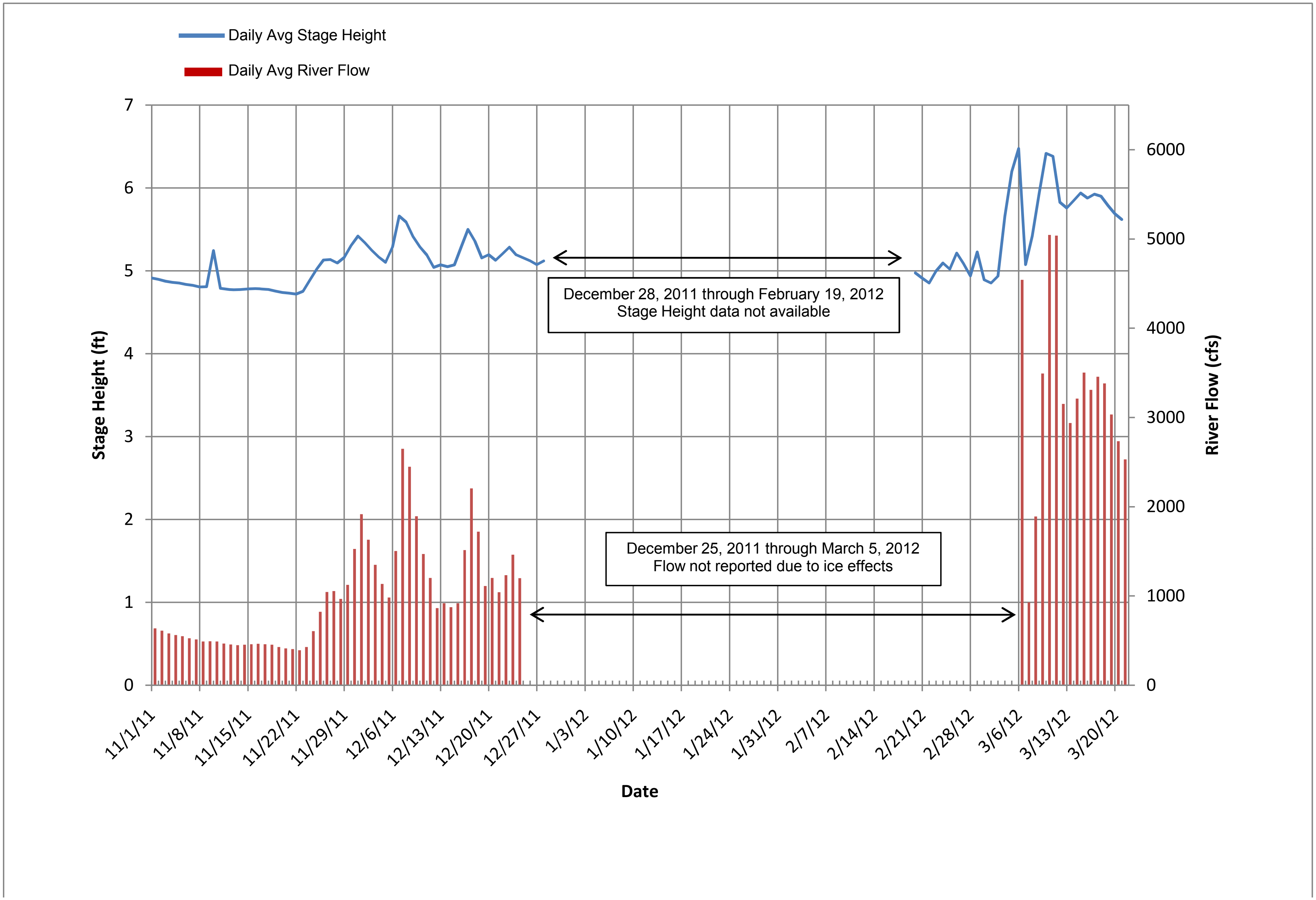


Figure 3-5b
Daily Average Stage Height and Flow for Winter 2011/2012
Chase Mills, NY USGS Gaging Station

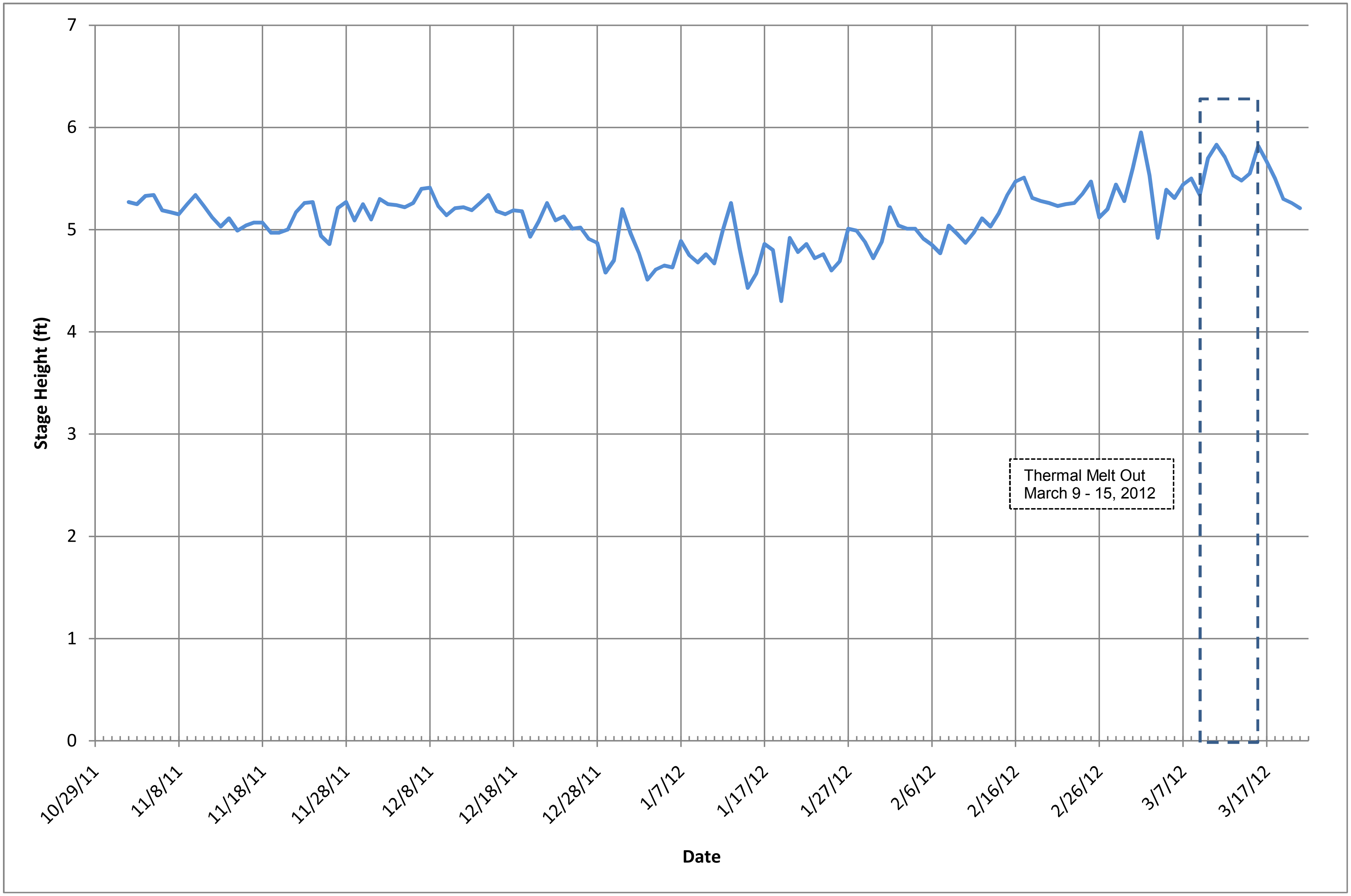
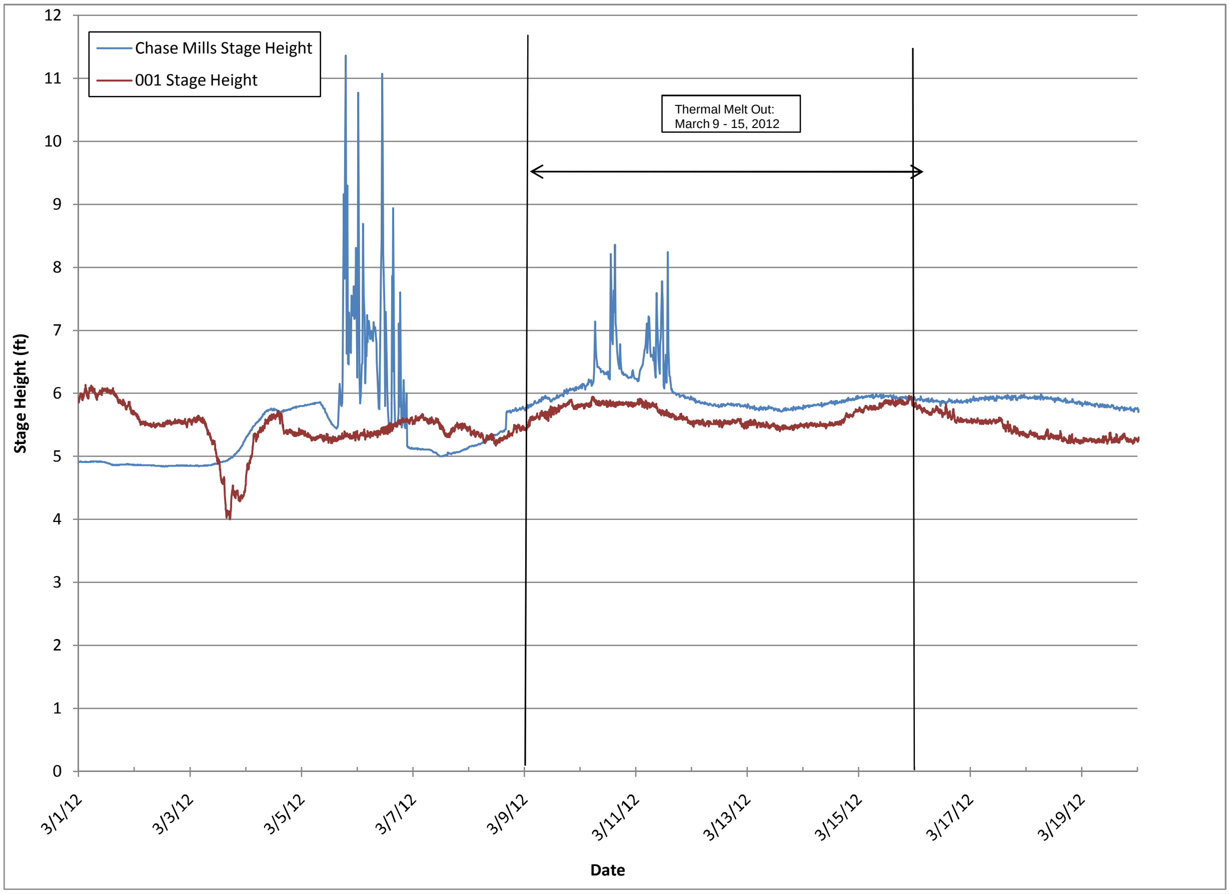


Figure 3-6
Daily Average Stage Height for Winter 2011/2012
Alcoa Outfall 001 Staff Gage
Massena, NY



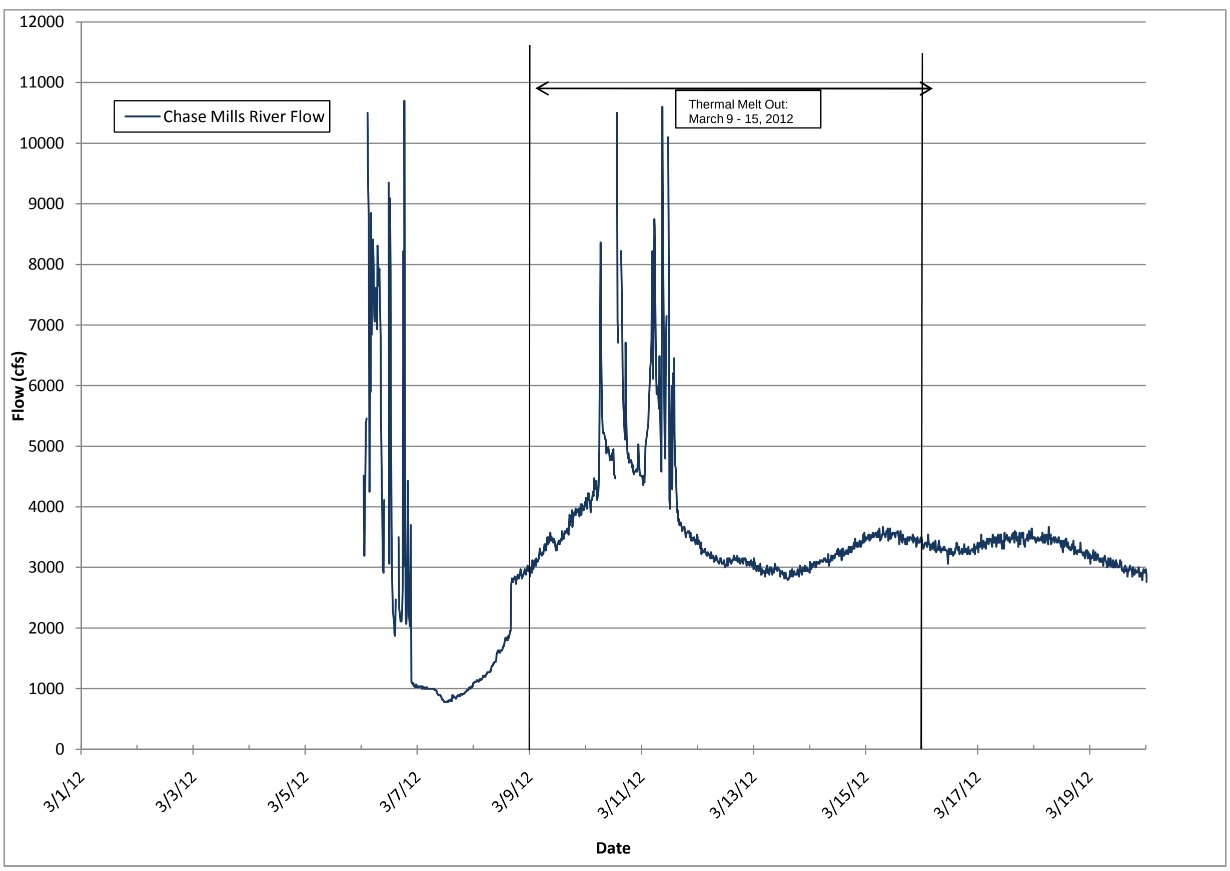
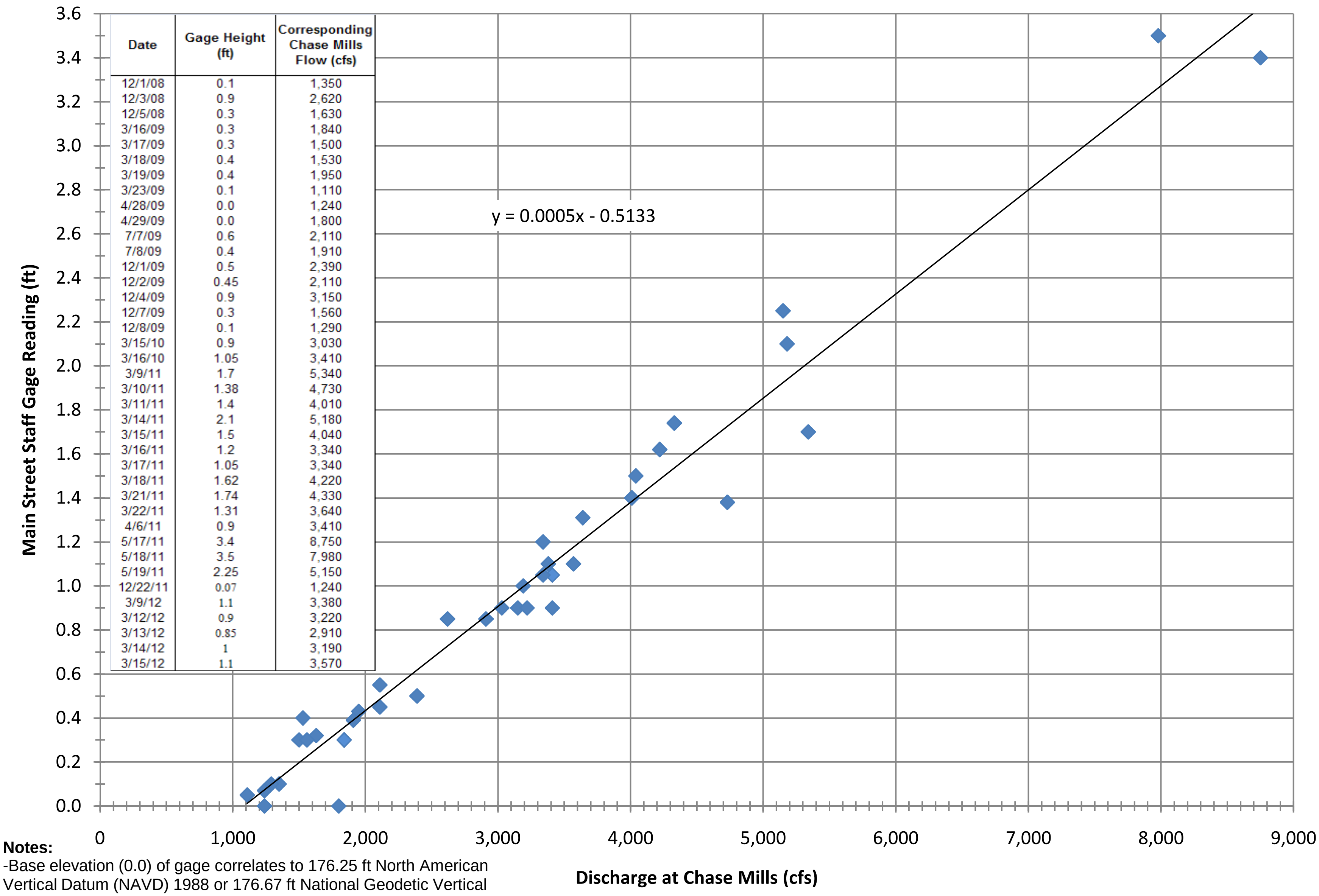


Figure 3-7
Real Time Stage Height and Flow for the Spring 2012 Ice Breakup
Chase Mills, NY USGS Staff Gage and Outfall 001 Staff Gage

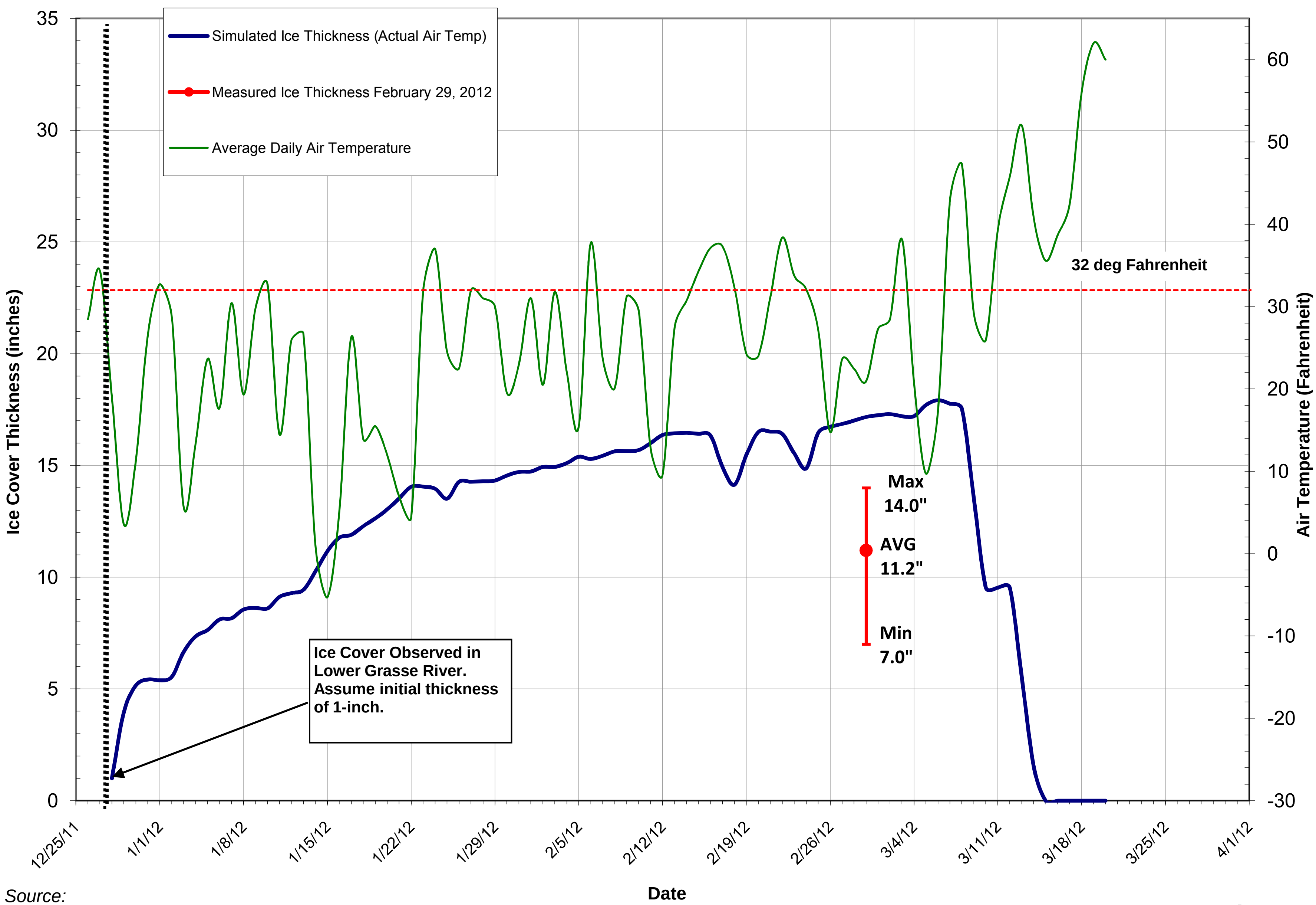


Date	Gage Height (ft)	Corresponding Chase Mills Flow (cfs)
12/1/08	0.1	1,350
12/3/08	0.9	2,620
12/5/08	0.3	1,630
3/16/09	0.3	1,840
3/17/09	0.3	1,500
3/18/09	0.4	1,530
3/19/09	0.4	1,950
3/23/09	0.1	1,110
4/28/09	0.0	1,240
4/29/09	0.0	1,800
7/7/09	0.6	2,110
7/8/09	0.4	1,910
12/1/09	0.5	2,390
12/2/09	0.45	2,110
12/4/09	0.9	3,150
12/7/09	0.3	1,560
12/8/09	0.1	1,290
3/15/10	0.9	3,030
3/16/10	1.05	3,410
3/9/11	1.7	5,340
3/10/11	1.38	4,730
3/11/11	1.4	4,010
3/14/11	2.1	5,180
3/15/11	1.5	4,040
3/16/11	1.2	3,340
3/17/11	1.05	3,340
3/18/11	1.62	4,220
3/21/11	1.74	4,330
3/22/11	1.31	3,640
4/6/11	0.9	3,410
5/17/11	3.4	8,750
5/18/11	3.5	7,980
5/19/11	2.25	5,150
12/22/11	0.07	1,240
3/9/12	1.1	3,380
3/12/12	0.9	3,220
3/13/12	0.85	2,910
3/14/12	1	3,190
3/15/12	1.1	3,570

Notes:
-Base elevation (0.0) of gage correlates to 176.25 ft North American Vertical Datum (NAVD) 1988 or 176.67 ft National Geodetic Vertical Dataum (NGVD) 1929

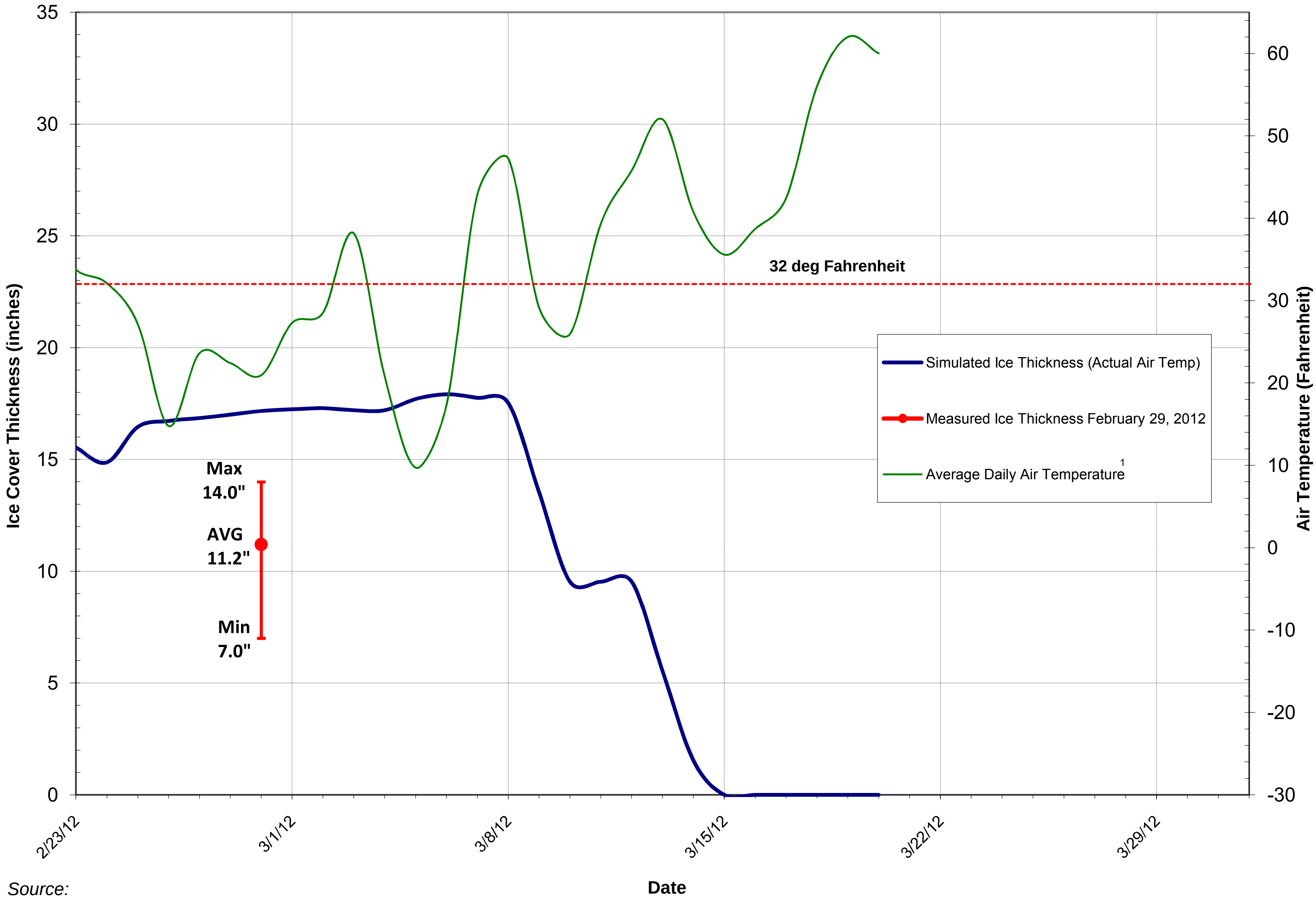
-Trend line created using the linear fit function in Microsoft Excel

Figure 3-8
Stage Height-Discharge Correlation Curve
Main Street Bridge Staff Gage



Source:
1. Actual Average Daily Temperature - The Massena International Airport

Figure 3-9
Lower Grasse River
Ice Thickness Forecasting Model
Simulated Results for Winter 2011/2012



Source:
1. Actual Average Daily Temperature - The Massena International Airport

Figure 3-10
Lower Grasse River
Ice Thickness Forecasting Model
Simulated Results Through Breakup

Figure 3-11a: Shoreline deterioration downstream of Alcoa Bridge (March 9, 2012 - Location 7)

Figure 3-11b: Deterioration of ice cover downstream of Route 37 Bridge (March 12, 2012 - Location 10)

Figure 3-11c: Continued deterioration of ice cover downstream of Alcoa Bridge (March 12, 2012 - Location 7)

Figure 3-11
Lower Grasse River
Photographs During 2011/2012 Spring Breakup

Figure 3-11d: Open channel downstream of Capping Pilot Study Area (March 13, 2012 - Location 5)

Figure 3-11e: Deterioration downstream of Route 37 Bridge (March 13, 2012 - Location 10)

Figure 3-11f: Deterioration and small ice floes downstream of Alcoa Bridge (March 14, 2012 - Location 7)

Figure 3-11
Lower Grasse River
Photographs During 2011/2012 Spring Breakup

Figure 3-11g: Deterioration downstream of Route 131 Bridge (March 14, 2012 - Location 4)

Figure 3-11h: River free of ice at Capping Pilot Study Area (March 14, 2012 - Location 5)

Location 3-11i: River free of ice downstream of Route 131 Bridge (March 15, 2012 - Location 4)

Figure 3-11
Lower Grasse River
Photographs During 2011/2012 Spring Breakup

Figure 3-11j: River free of ice downstream of Alcoa Bridge (March 15, 2012 - Location 7)

Figure 3-11k: River free of ice at Haverstock Road (March 15, 2012 - Location 2)

Figure 3-11
Lower Grasse River
Photographs During 2011/2012 Spring Breakup

SECTION 4
QUALITY ASSURANCE/QUALITY CONTROL

4.1 INTRODUCTION

This section describes the quality control evaluation conducted for the water column and resident fish data collected from the lower Grasse River in 2011 as part of the SRS Program. Guidelines set forth in the *2008 Routine Monitoring Activities Correspondence* were supplemented, where appropriate, with those discussed in the Quality Assurance Project Plan (QAPP) developed for the Grasse River project (Blasland, Bouck & Lee, Inc. [BBL], September 1993). These guidelines were established to assess whether field, laboratory, and data management activities were performed in a manner that is appropriate for accomplishing the project objectives.

The procedures and metrics used in the QA/QC evaluation are presented in Section 4.2, while the results of the data evaluation are discussed in Section 4.3.

4.2 QA/QC PROCEDURES

The QA/QC procedures used to evaluate the data collected during 2011 consisted of several steps, including:

- review of the field chain-of-custody (COC) forms and data received from the laboratory for completeness;
- automation of data compilation, when possible, to minimize errors within the database; and
- review of the QA/QC data to assure that results of the quality control analyses are within the control limits developed for the project.

Upon receipt of the data, the field COC forms were reviewed and compared to the data received from the laboratory to ensure that sample identifications listed on the COC forms matched those reported in the data packages. This process was used to check that results were reported for all field and QA/QC samples (such as MS/MSD).

Following this review, the data were compiled and entered into an Excel database. All data from the laboratory were received electronically and appended, when possible, to the existing database using tools available in Microsoft Excel and Interactive Data Language (IDL). During the rare occasions when tools could not be used (i.e., data arrived in portable document format [PDF]), data were manually input into the databases.

After the data were incorporated into the project database, several metrics (as outlined in the QAPP) were evaluated to determine the quality of the water column and resident fish data. Data metrics used in this evaluation included:

- overall data completeness;
- method detection limits (MDL);
- number of QA/QC samples collected and analyzed;
- blank analysis;
- MS and MSD analyses; and
- field duplicate analysis.

Data were deemed acceptable if the following criteria were satisfied:

- Overall data completeness equaled or exceeded 90%. Overall data completeness was computed by dividing the number of valid data obtained by the total number of data planned for collection and analyses.
- MDLs from the QAPP for total PCBs quantified on an Aroclor basis in water and biota samples were about 0.065 micrograms per liter (µg/L) and 0.05 mg/kg, respectively. MDLs for total PCB congeners were not specified. The MDL for TSS in water was 1.0 mg/L.

- For the routine water column samples, a minimum of one equipment rinse blank was collected before and after sampling. In addition, at least one duplicate sample and one MS/MSD pair were collected each round.
- For resident fish samples, a minimum of one MS/MSD pair was prepared by the laboratory for every twenty submitted field samples.
- PCB levels in laboratory, equipment (rinse), and method blanks were near or below the detection limit.
- Percent recoveries for MS/MSD samples of water analyzed for total PCBs were between 70% and 130% (to evaluate accuracy).
- The relative percent difference between MS/MSD samples analyzed for total PCBs were less than 35% (to evaluate precision).
- Criteria for relative percent differences between field samples and their duplicates analyzed for total PCBs or TSS were not prescribed in the QAPP.

Results of the QA/QC evaluation are discussed in Section 4.3.

4.3 RESULTS OF QA/QC ANALYSES

This section presents the results of the QA/QC analyses performed on water column and resident fish data collected in 2011.

4.3.1 Water Column

This subsection reports the assessment of QA/QC data collected during the 2011 routine water monitoring program.

Completeness. Samples (one bottle for PCB analysis and one bottle for TSS analysis at each sampling transect) were collected as planned for all four transects during the nine rounds of routine monitoring in 2011 in accordance with the *2008 Routine Monitoring Activities Correspondence* and procedures identified in the *2005 Monitoring Work Plan*.

The result of one river sample collected on June 2, 2011 (WC013-2 [0.8]) shows a congener pattern that does not resemble the typical pattern observed in the Grasse River, suggesting cross contamination at some indeterminable point. This sample has been excluded from the analyses included in Section 2 and flagged in the database. In addition, the temperature of a sample cooler was slightly elevated upon arrival at the laboratory during sampling Rounds 1 and 2 (8.8° and 8.2°C, respectively, versus 4°C). The laboratory proceeded with analysis of the samples in these coolers, and the elevated temperature was noted.

Method detection limit. Since a MDL was not prescribed for PCB congeners, the MDL for Aroclors was used for comparison. The lower bound estimate of the nominal MDL for routine monitoring water samples was about 27.8 ng/L for total PCBs (Alcoa, April 2002), below the QAPP requirement of 65 ng/L.

The MDL for TSS measured as part of routine monitoring met the requirement of 1.0 mg/L.

Number of QA/QC samples. The number of field duplicates and MS/MSD pairs collected during routine monitoring met the requirement of one per round (nine). The number of rinse blanks collected met the requirement of 18. Additional QA/QC samples for PCBs included nine laboratory blanks and nine laboratory control spikes.

The requirement of one field duplicate per sampling round for TSS analysis was fulfilled for routine monitoring.

Blanks. All laboratory and rinse blank concentrations were below the nominal detection limit.

Matrix spike and matrix spike duplicates. All MS/MSD samples were within the prescribed range for MS/MSD percent recovery and relative percent difference.

Field duplicates. The relative percent difference between the nine pairs of samples and their duplicates analyzed for total PCBs and for TSS ranged from 0.0% to 200% and 0.9% to 80%, respectively. Criteria for the relative percent differences between samples and their duplicates analyzed for total PCBs and for TSS were not defined in the QAPP.

4.3.2 Resident Fish

This subsection reports the assessment of QA/QC data collected during the resident fish monitoring program.

Completeness. All samples were collected as stated in the *2008 Routine Monitoring Activities Correspondence* and the procedures identified in the *2005 Monitoring Work Plan*. A total of 144 samples were submitted to the laboratory for PCB and lipid analysis. No samples were lost during shipment or analysis.

Method detection limit. Twenty of the 144 samples submitted to the laboratory had PCB levels that were reported below the detection limit. All samples were analyzed at the 0.05 mg/kg wet weight MDL defined in the QAPP. It should be noted that samples were reported as non-detect by the laboratory if their concentrations were less than the practical quantitation limit.

Number of QA/QC samples. Eleven MS/MSD pairs were extracted, analyzed, and reported by the laboratory, which exceeds the requirement of seven pairs. In addition, eleven method blanks and eleven laboratory control spikes (twelve for PCBs, thirteen for lipids) were included for analysis.

Blanks. All method blanks contained non-detectable PCB levels.

Matrix spike and matrix spike duplicates. All MS/MSD sample pairs had relative percent differences within prescribed limits.

Field duplicates. The collection of field duplicates was not performed as part of the resident fish sampling program.

4.4 SUMMARY

Overall, the quality of the data for water column and resident fish samples collected during 2011 met the guidelines established for the project. These data, with one exception, were deemed appropriate for use in performing qualitative and quantitative evaluations required to satisfy the project objectives.

SECTION 5
REFERENCES

Alcoa, July 2011. *2010 Data Summary Report*.

Alcoa, June 2009. *2008 Data Summary Report*.

Alcoa, April 2009. *Draft Addendum to the Comprehensive Characterization of the Lower Grasse River.*

Alcoa, March 2005. *2005 Monitoring Program Work Plan.*

Alcoa, April 2002. *Documentation Report – Grasse River Capping Pilot Study.*

Alcoa, April 2001. *Comprehensive Characterization of the Lower Grasse River.*

BBL, September 1993. *River and Sediment Investigation (RSI) Phase II Site Operations Plan*, Grasse River Site, Massena, New York.

Appendix A

This appendix contains the Grasse River Environmental Database in two formats: Microsoft Access and text files formatted for EquIS. This database is provided electronically on the enclosed CD. A data dictionary is also included to facilitate use of the database.

Appendix A: Section 1 – Data Dictionary for SRS Environmental Database

Appendix A: Section 2 – Data Dictionary for ROPS Environmental Database

Appendix B

Spring 2012 Ice Monitoring Photos

ALCOA